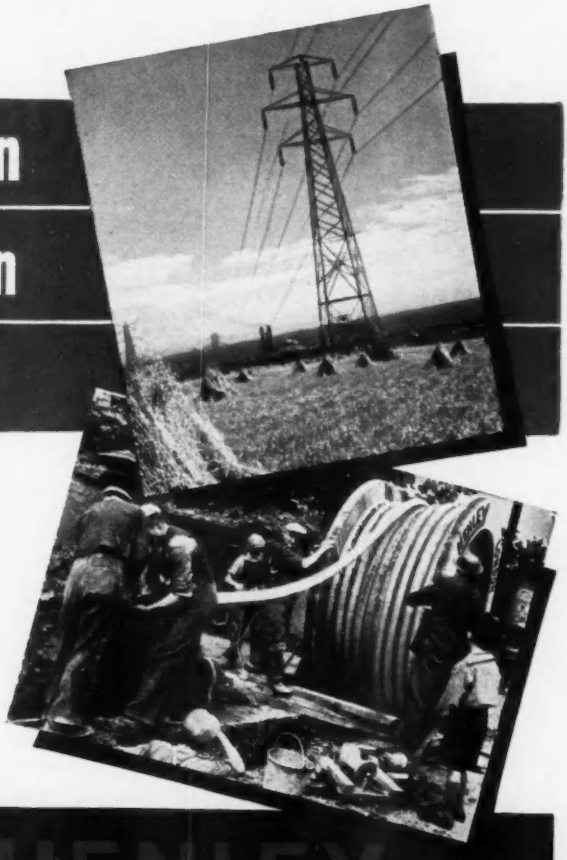
ELECTRICAL TIMES

THURSDAY
22 MARCH
1951

SIXPENCE

Specialists in Super-Tension Installations



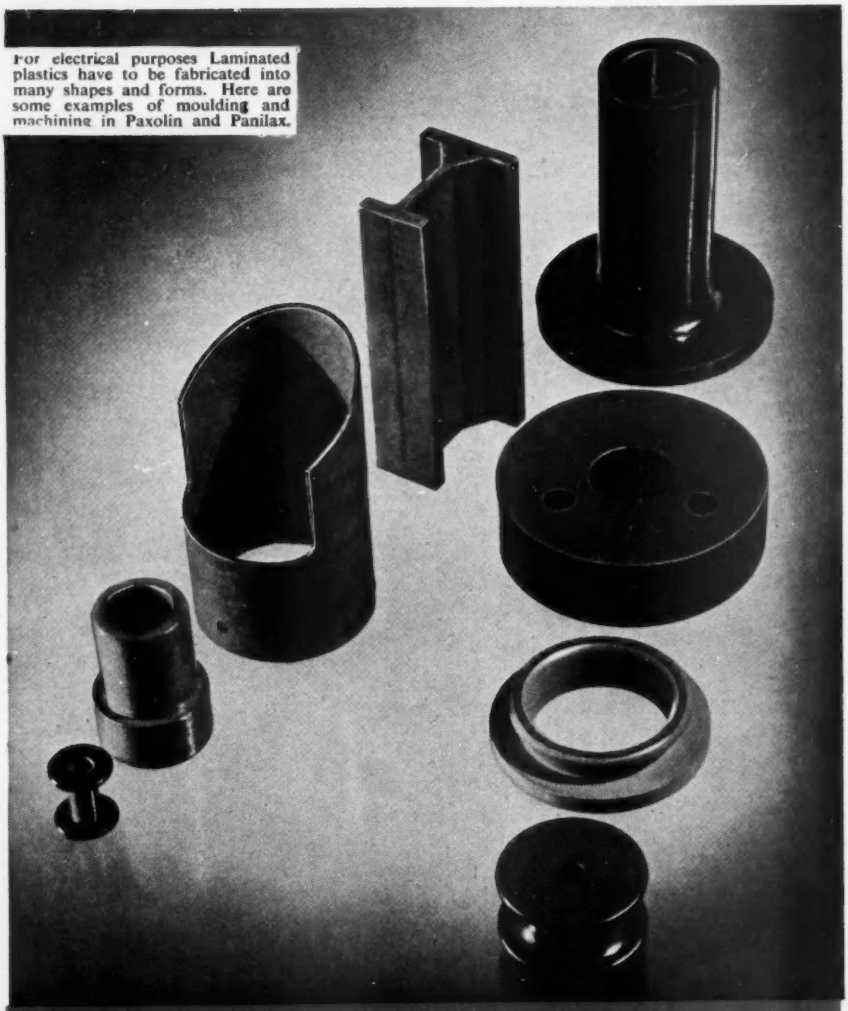
Henley's specialise in the complete manufacture and installation of super-tension cables and accessories and in the erection of overhead transmission lines.

BY APPOINTMENT
ELECTRIC CABLE
MANUFACTURERS

HENLEY

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

For electrical purposes Laminated plastics have to be fabricated into many shapes and forms. Here are some examples of moulding and machining in Paxolin and Panilax.



m and i

THE MICANITE & INSULATORS CO. LTD.

Empire Works, Blackhorse Lane, Walthamstow, London, E.17

Branch Offices at Birmingham, Cardiff, Glasgow, Manchester and Newcastle-upon-Tyne, and representatives in most countries throughout the world.

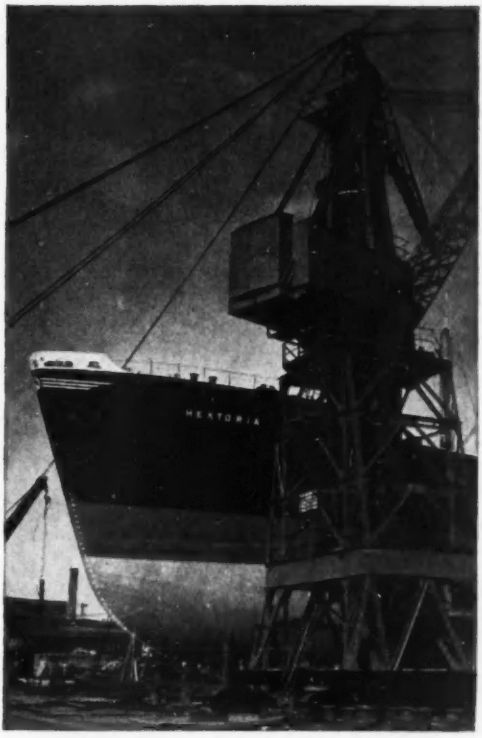
Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS and TERMINALS. Distributors of Micoflex-Duratube Sleeving and Micoflex Durasleeve (Plastics-covered flexible metal conduit)

'ENGLISH ELECTRIC'

A.C. arc-welding

Clyde-Built, Arc-Welded M.V. 'Hektoria'

Launched last September from Messrs. Lithgow's Clydeside shipyard, the 13,500 ton A/F Hektor motor tanker 'Hektoria' is a good example of current shipbuilding technique — workshop fabricated in sections and assembled by arc-welding on the ways.



The 'English-Electric' A.C. Arc-Welding equipment used by the builders is of standard pattern, distributing welding current at 100 volts through 180 and 360 kVA welding transformers, controlled by 300 or 400 amp. regulators.

'English Electric' equipment is helping many British shipyards to quote competitive prices at a time when international competition in the industry is reaching formidable levels.

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Welding Equipment Department, East Lancashire Road, Liverpool 10

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL

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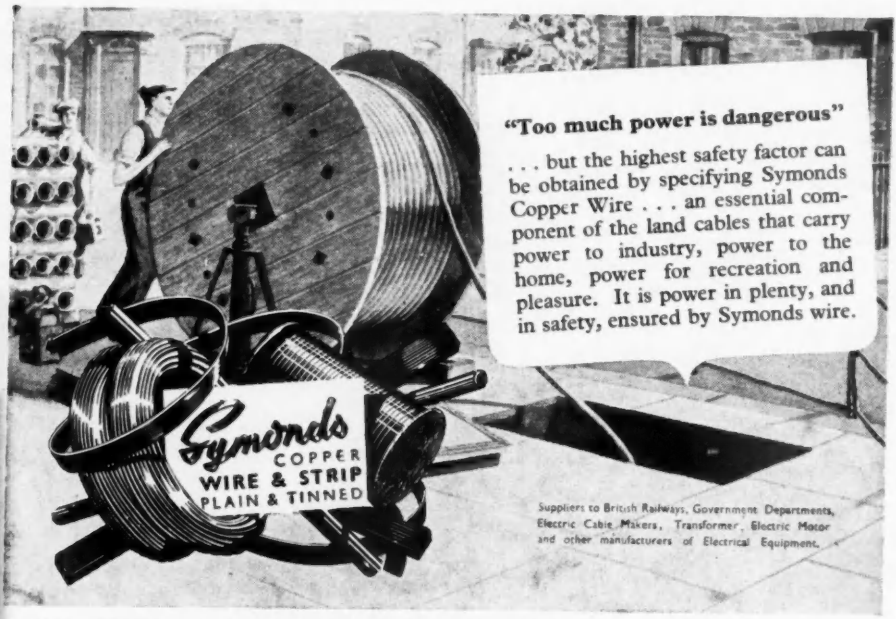
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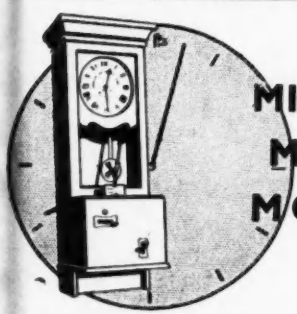

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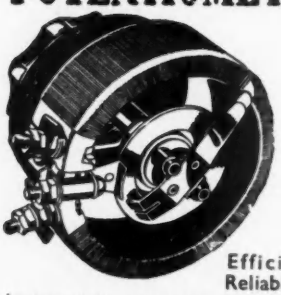

Efficient and Reliable, these instruments are second to none. Our Technical service will be happy to advise you in any difficulty, so do not hesitate to get in touch with us soon.

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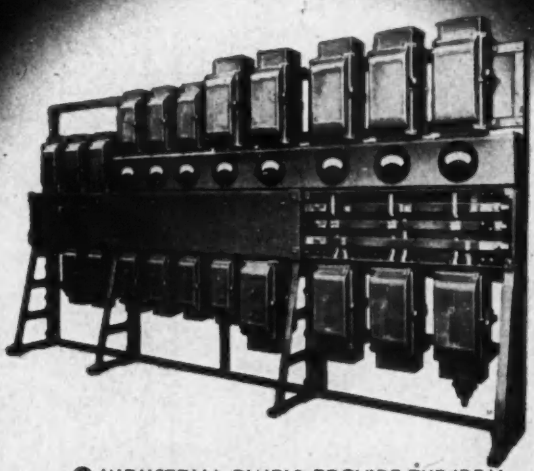

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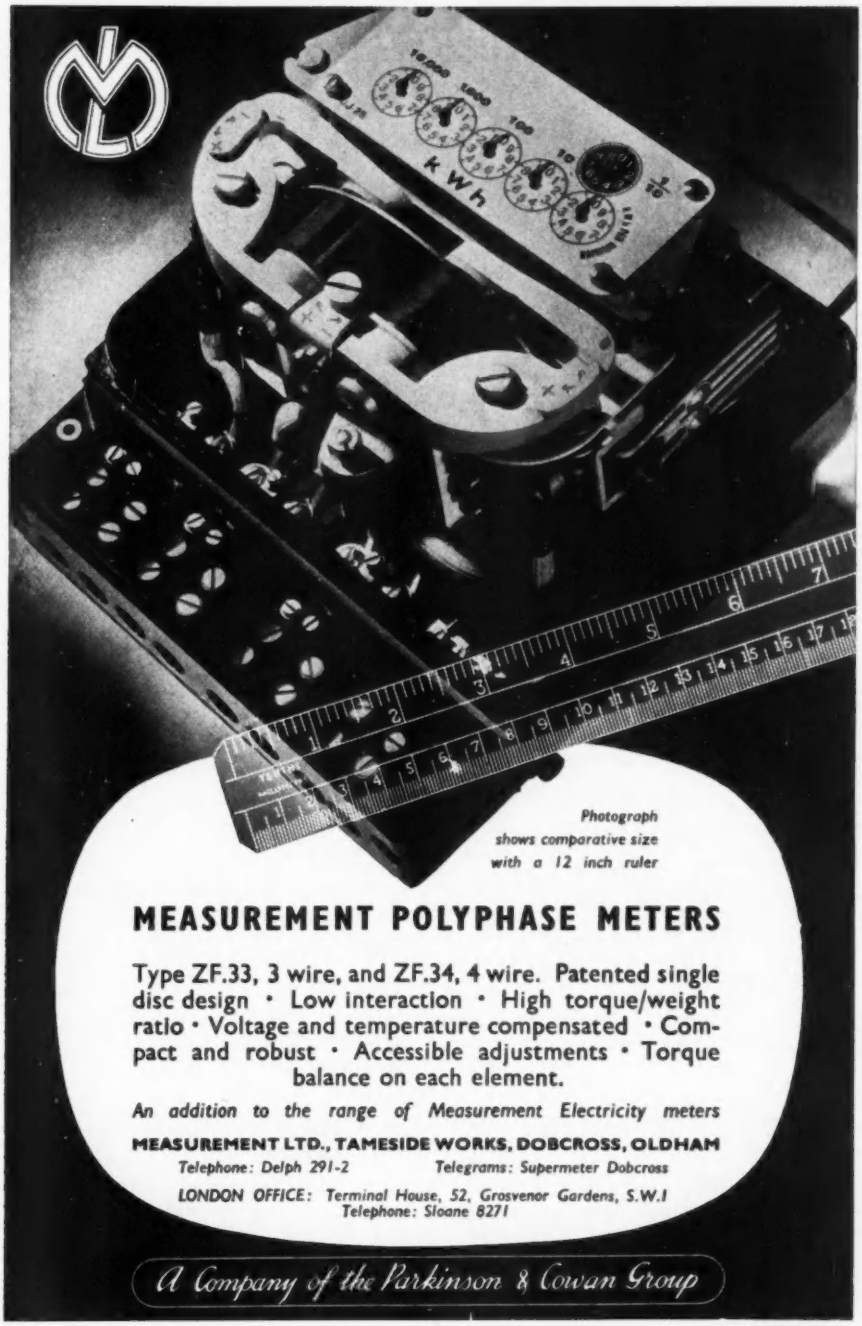

Photograph shows comparative size with a 12 inch ruler

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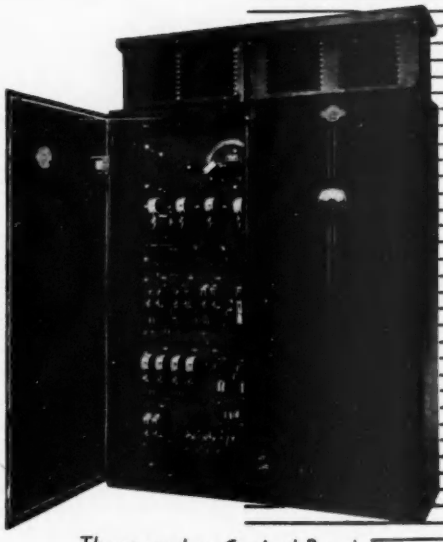
Many years' experience and constant co-operation with manufacturers and users of electrically operated machinery has enabled us to produce control units which are pre-eminently suited to the specific requirements of each particular industry.



Three-motor Control Panel for large boring machine Approximate height 7-feet.

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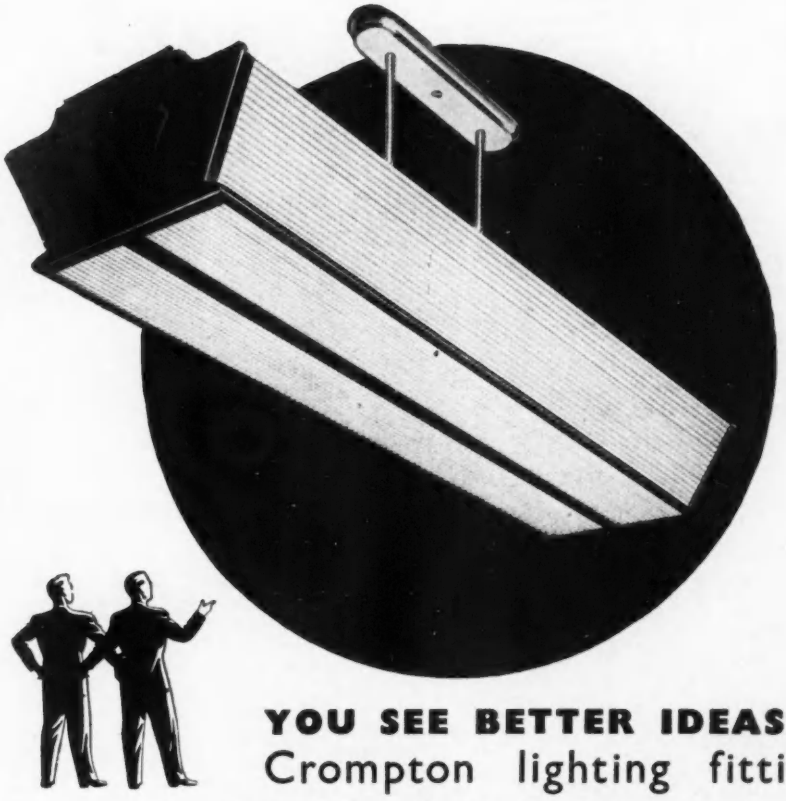

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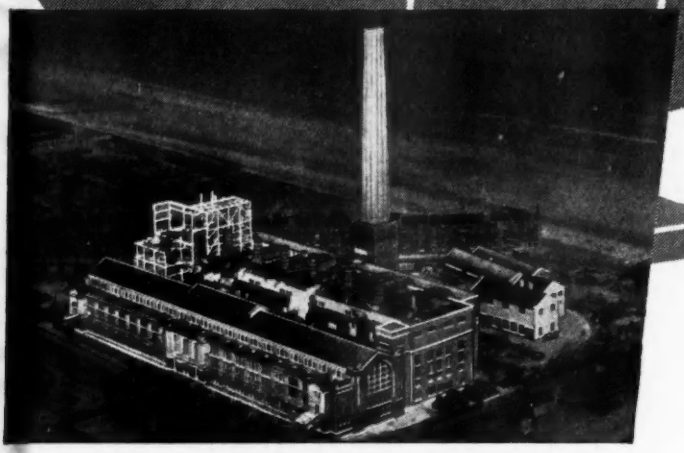
P & G BATTERIES in the public service



Behind a number of Britain's large scale enterprises lies the quiet efficiency of P & G Batteries. The generation of electricity is a case in point. The Portobello Power Station at Edinburgh (shown here) employs P & G Stationary Batteries for Switchgear Operation, Emergency Lighting and other duties. Portobello is one of many. P & G service extends into many fields and covers complete specifications for any battery installation you care to name, a second and impartial opinion on an existing scheme, the provision of equipment and its installation, regular inspection and report. We welcome discussion on any project on the sound principle that two heads are invariably better than one.

2 *heads are better than* **1**

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CARDIFF
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Central Electrical Works, Wharf St., Cardiff. (Tel. No.: Cardiff 6520.)

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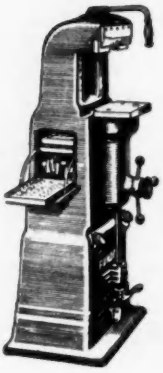
Funditor

Breaks new Ground in marking



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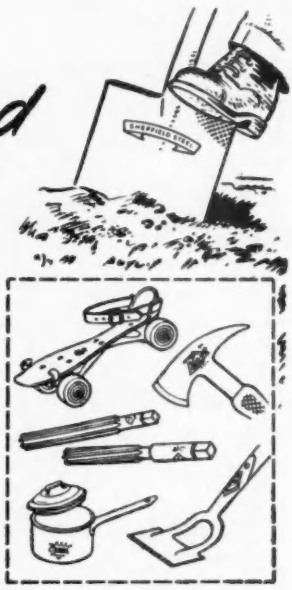
See our Stands Nos. F.34 Olympia and D.324 Castle Bromwich, B.I.F.



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Other Funditor Products: "Sand-jet" Marking Machines, Supersaw for Plastics, Drying Ovens, special Electrical Heating Elements.

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With acknowledgements to Electrolux Ltd.

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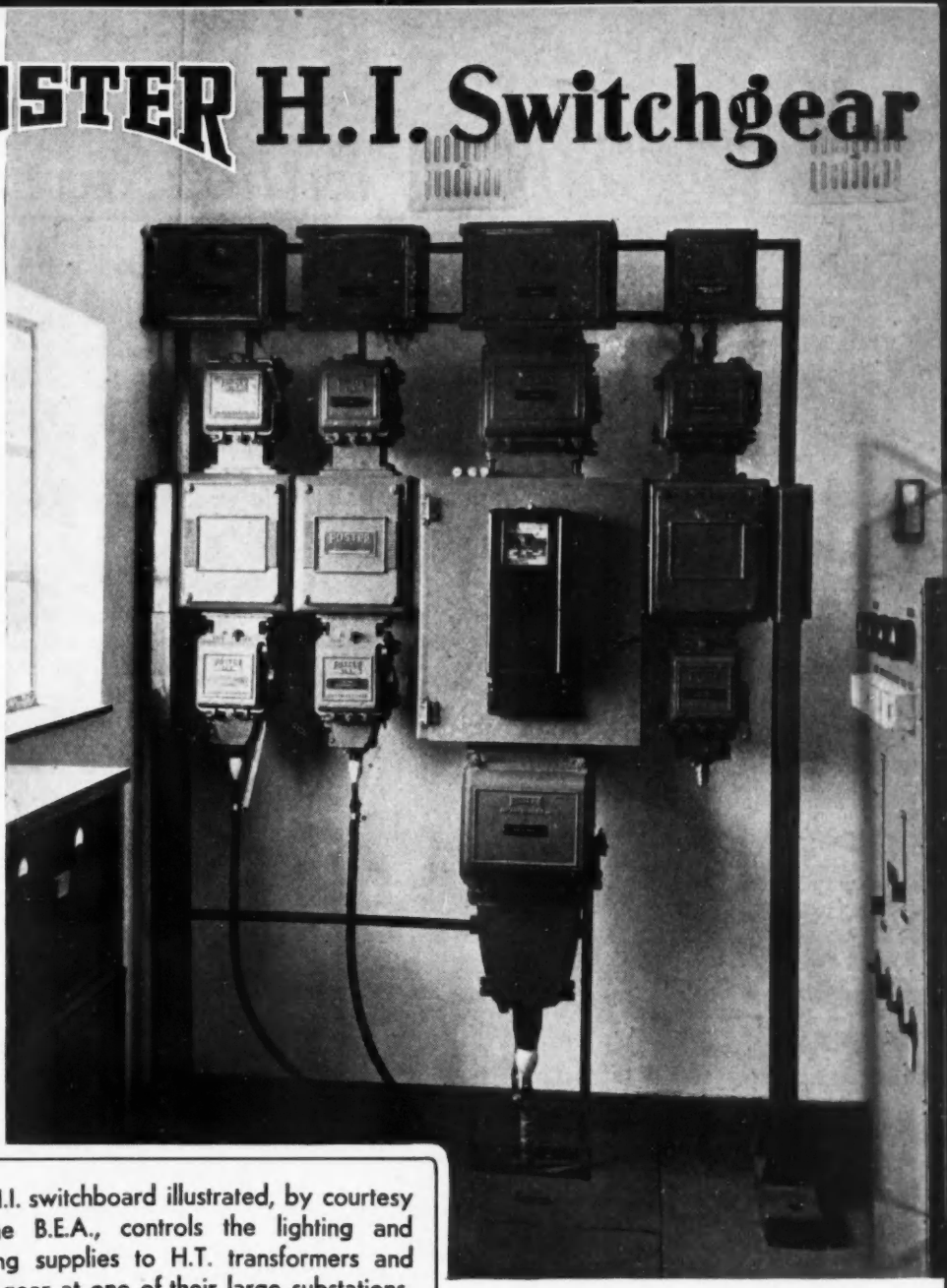
FOSTER H.I. Switchgear



The H.I. switchboard illustrated, by courtesy of the B.E.A., controls the lighting and tripping supplies to H.T. transformers and switchgear at one of their large substations.

Foster Transformers & Switchgear Ltd

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REVO 'PEERLESS'

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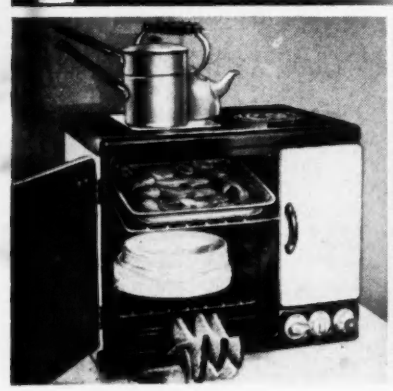
appeal to housewife and engineer alike.

Nothing could be more compact, more convenient, more capacious, more economical, or more reasonably priced than this portable electric cooker by Revo.
It can be supplied for table use or with a special stand (as illustrated on the right), and meets the present-day need for greater fuel economy.

(patent applied for)



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loading . . .

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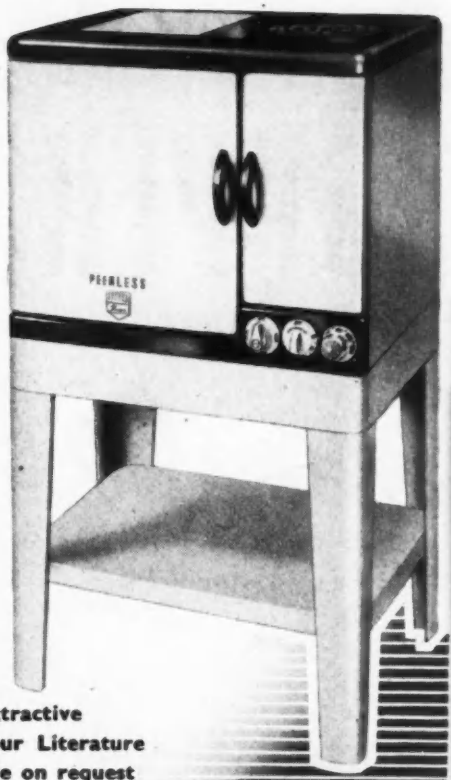

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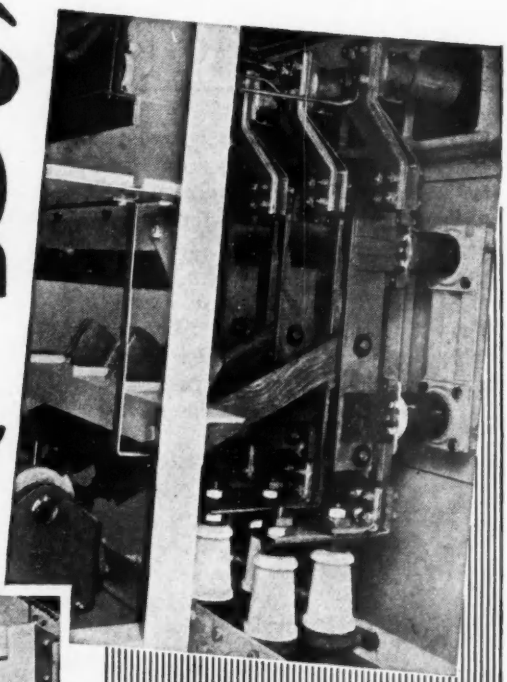
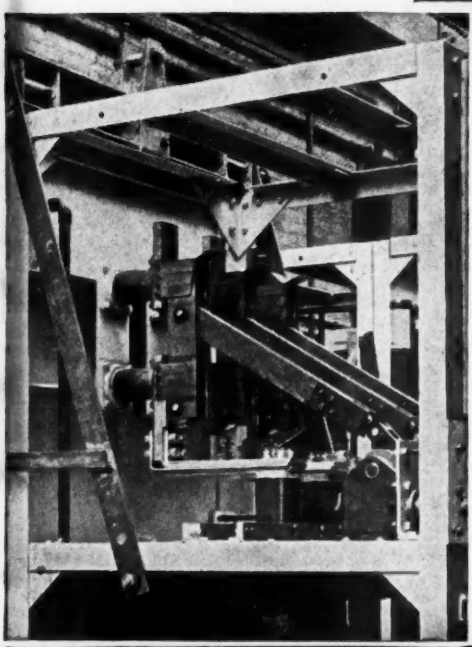
ANACOS REGD. COPPER IN *Industry*





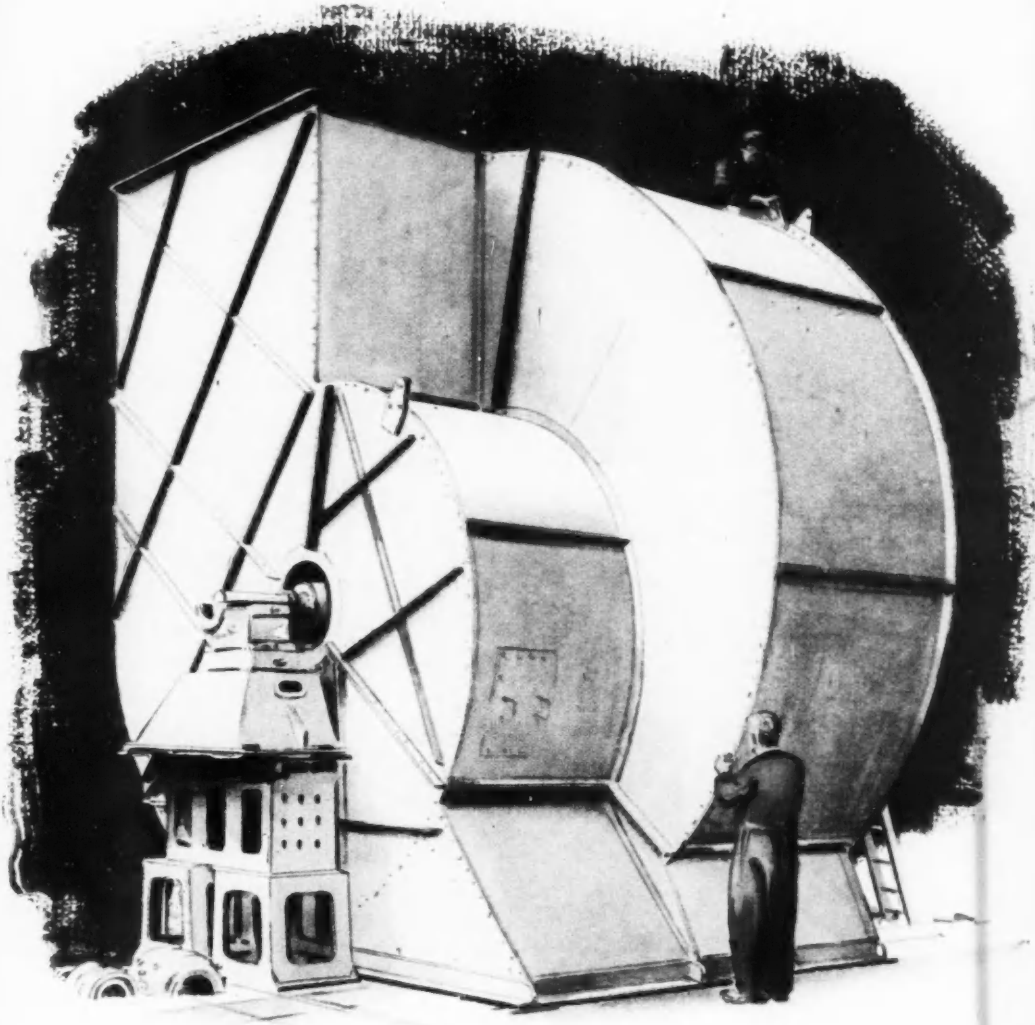
INCORPORATED IN THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED
FS & CO

The photographs (kindly loaned by Messrs. Switchgear & Cowans Ltd.) show isolating switches using "ANACOS" Copper.

FREDERICK SMITH & COMPANY

ANACONDA WORKS : SALFORD 3 : LANCS

Incorporated in The London Electric Wire Company and Smiths, Limited
Associated with The Liverpool Electric Cable Co., Ltd. and Vactite Wire Co. Ltd.



Under construction: Howden single-inlet induced draught fan with integral scroll-type dust collector and steam turbine drive, for Vereeniging South Africa.

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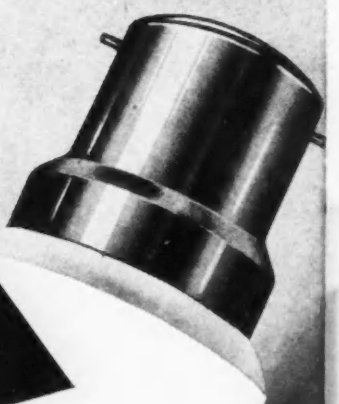

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"EDISWAN"

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150 watt 2/9 200 watt 4/6

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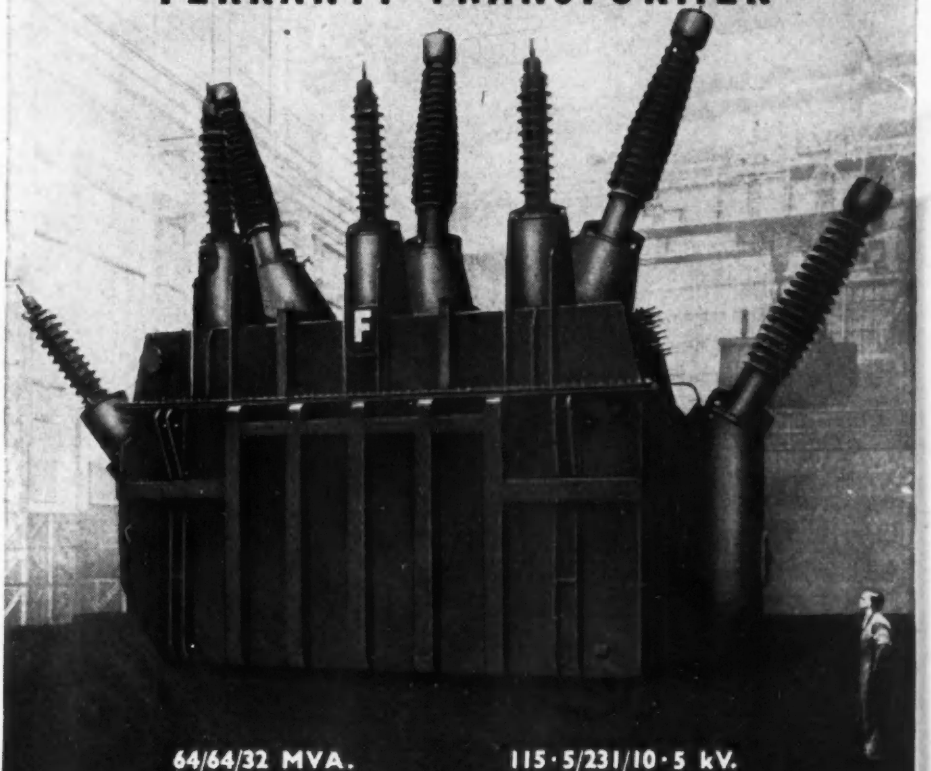
A 3-Phase 230 kV
FERRANTI TRANSFORMER



64/64/32 MVA. 115·5/231/10·5 kV.

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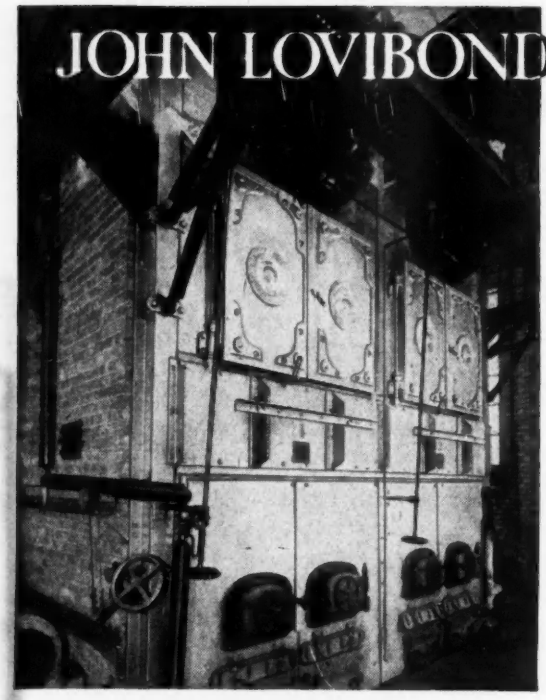
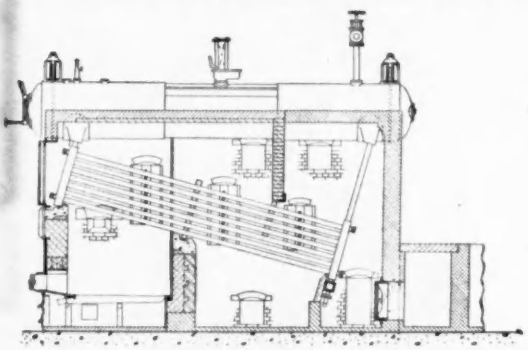


BABCOCK & WILCOX LIMITED, in addition to manufacturing large steam raising units for Central Power Stations, supply smaller units to a wide variety of industrial users.



The large illustration shows two B. & W. "W.I.F." type boilers, each with an M.C.R. of 5000 lb./hr. at 150 p.s.i., supplied to the old established Greenwich Brewery of John Lovibond & Sons Limited.

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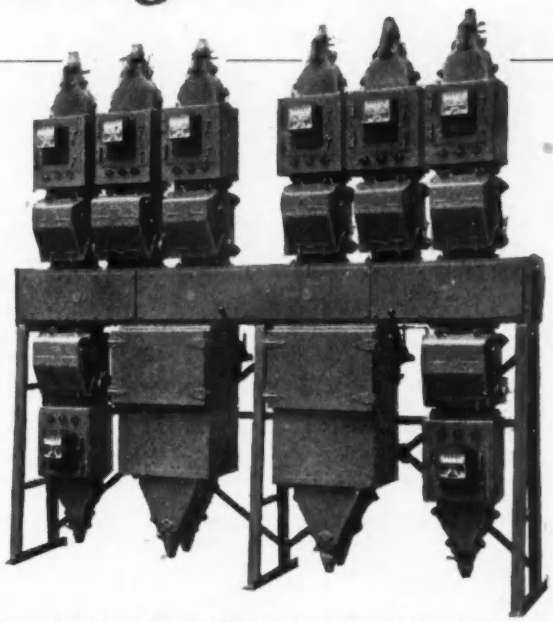

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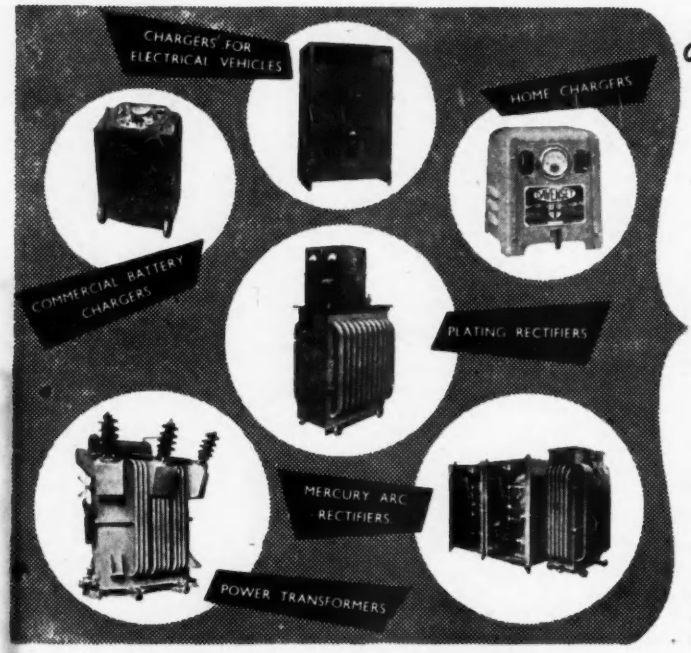

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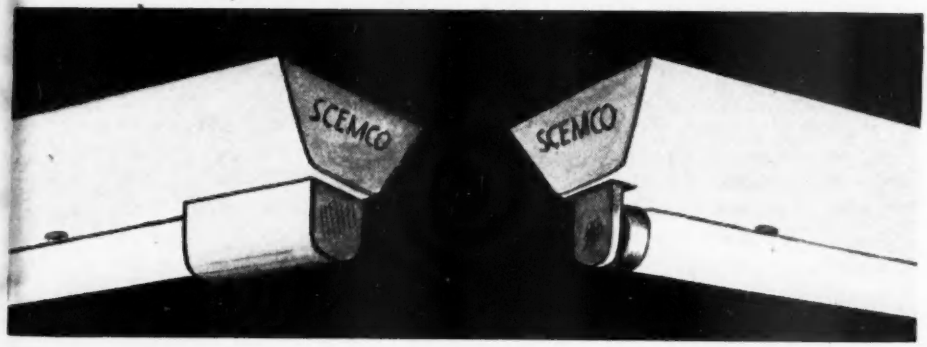

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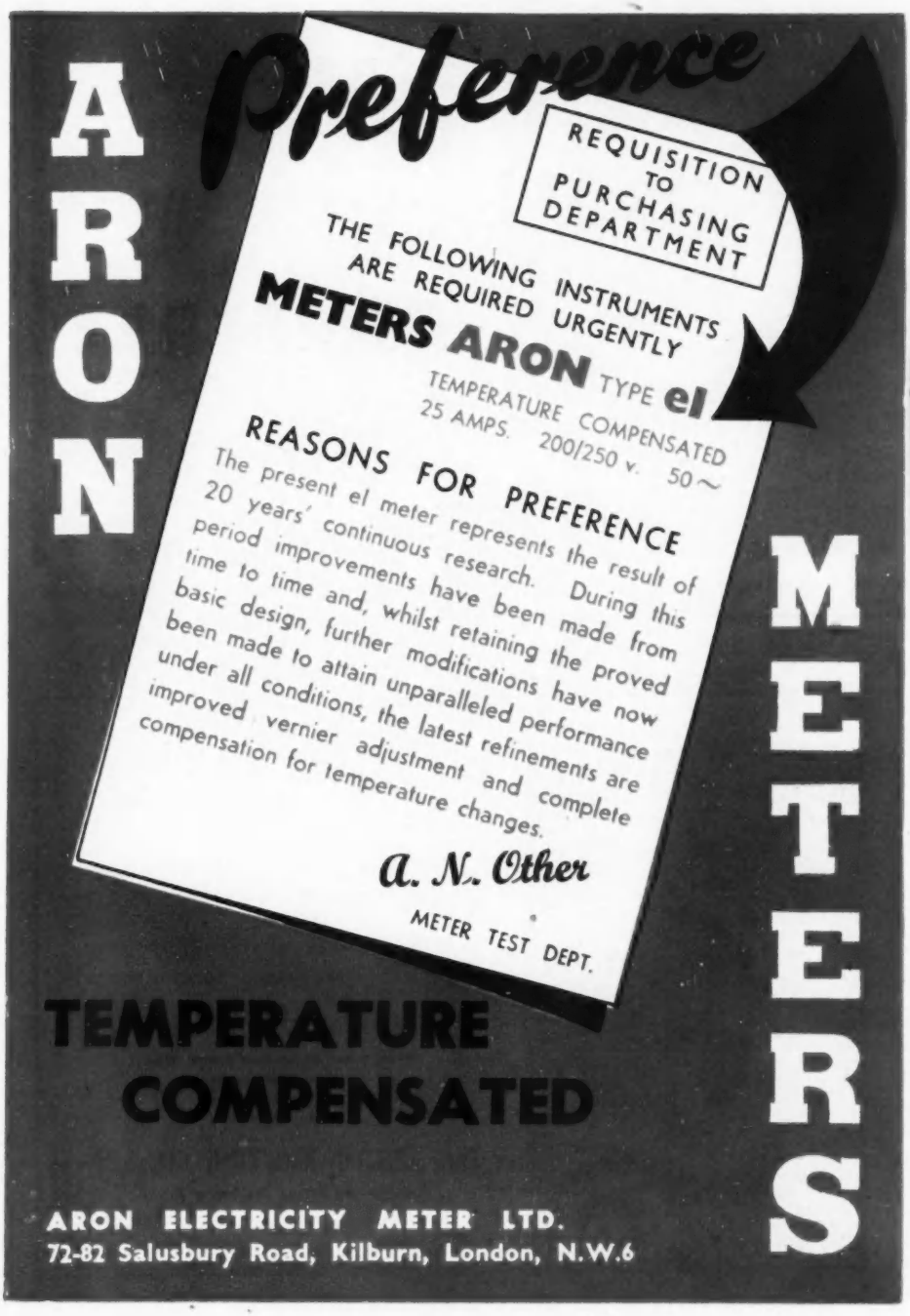
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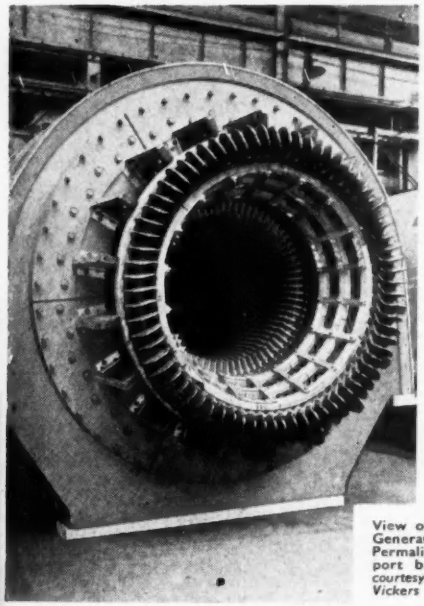

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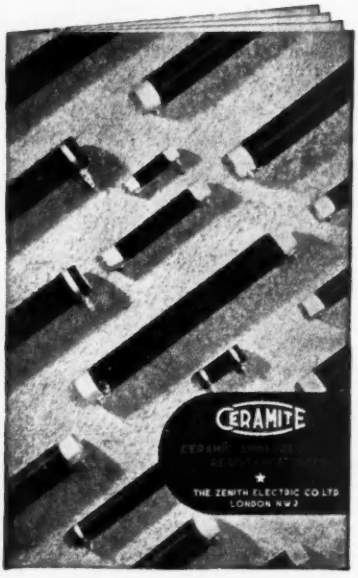

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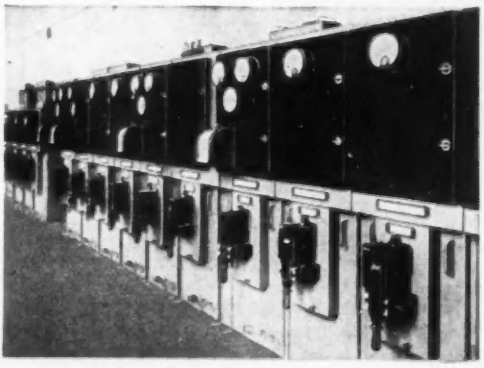

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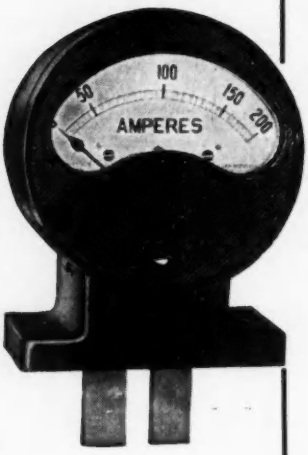

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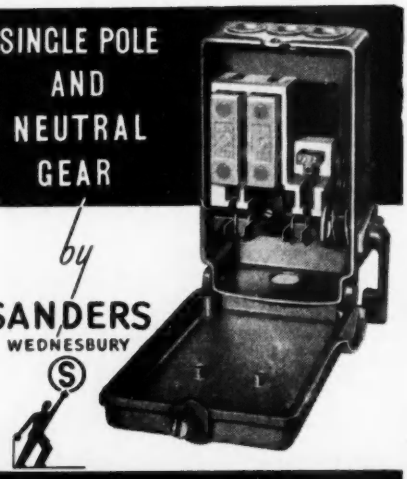

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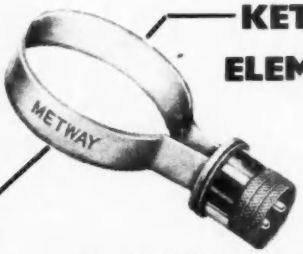

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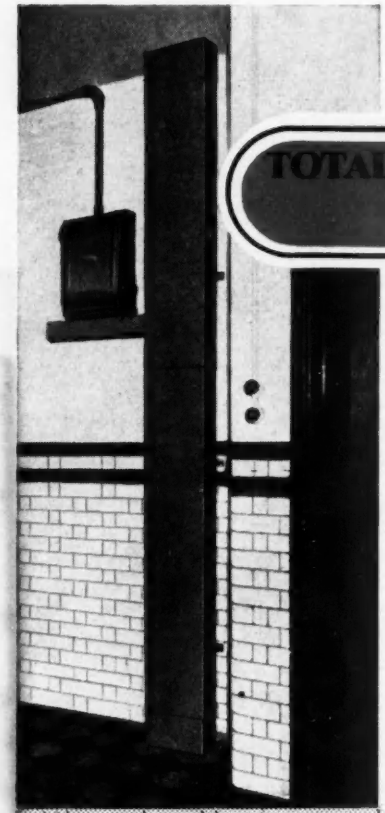

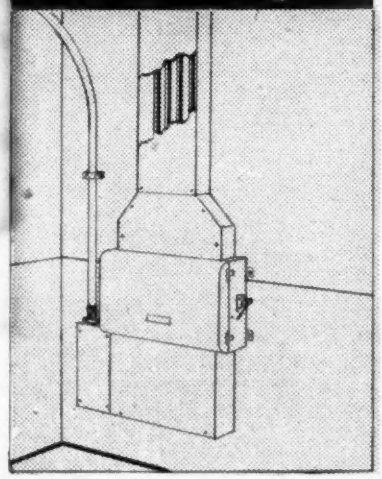

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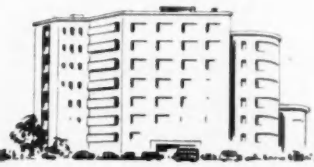

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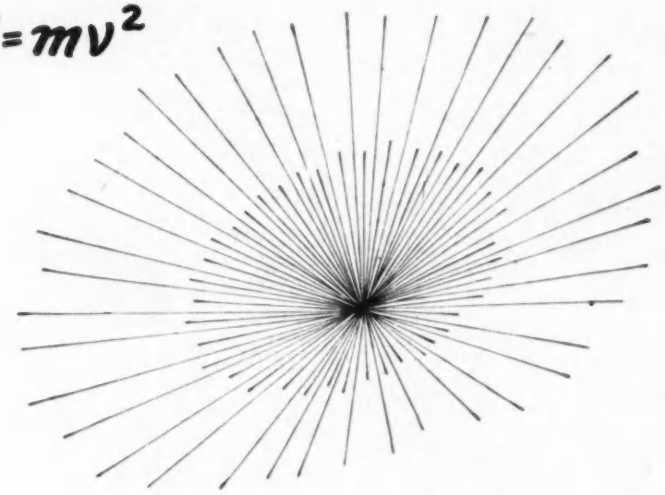

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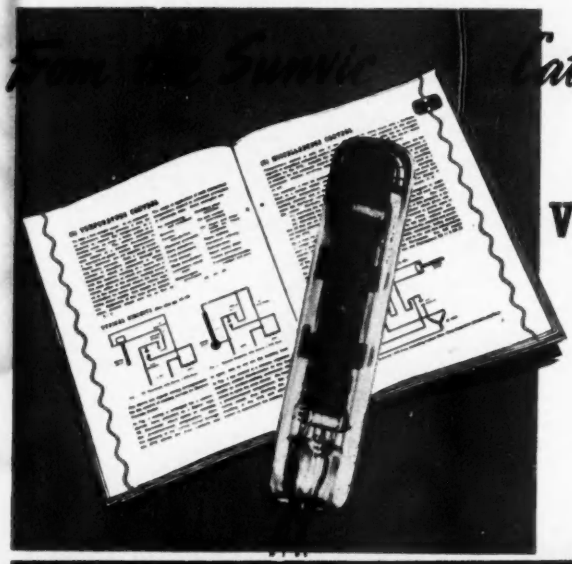

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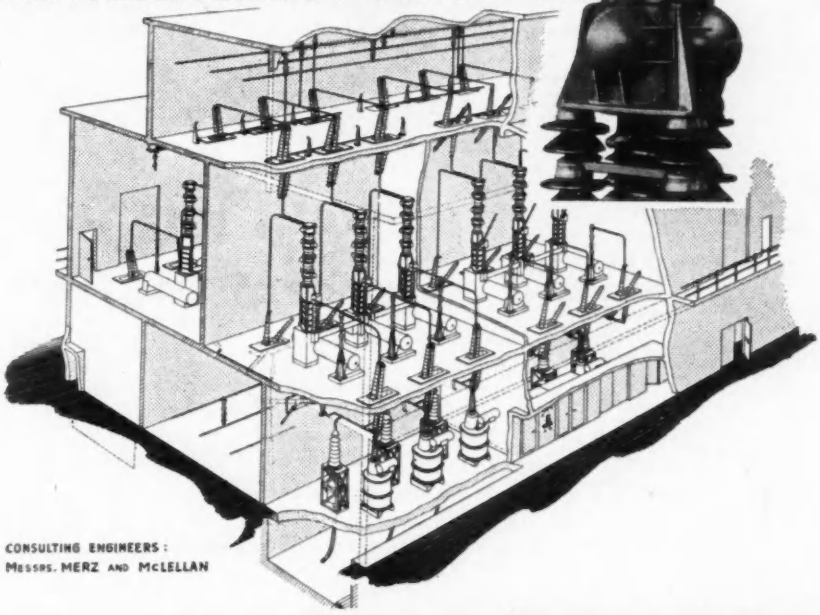

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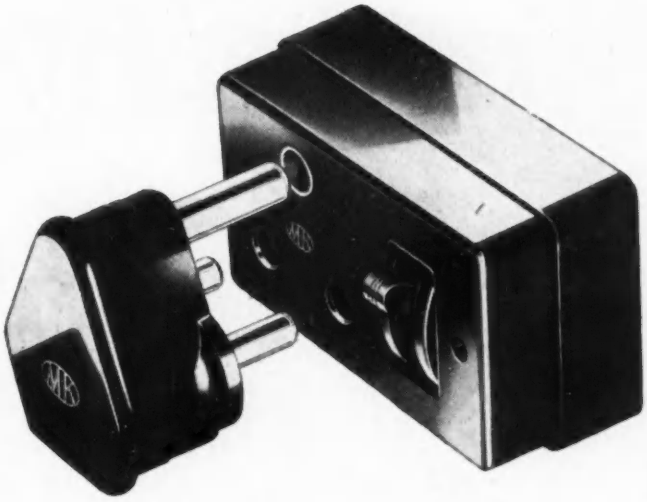

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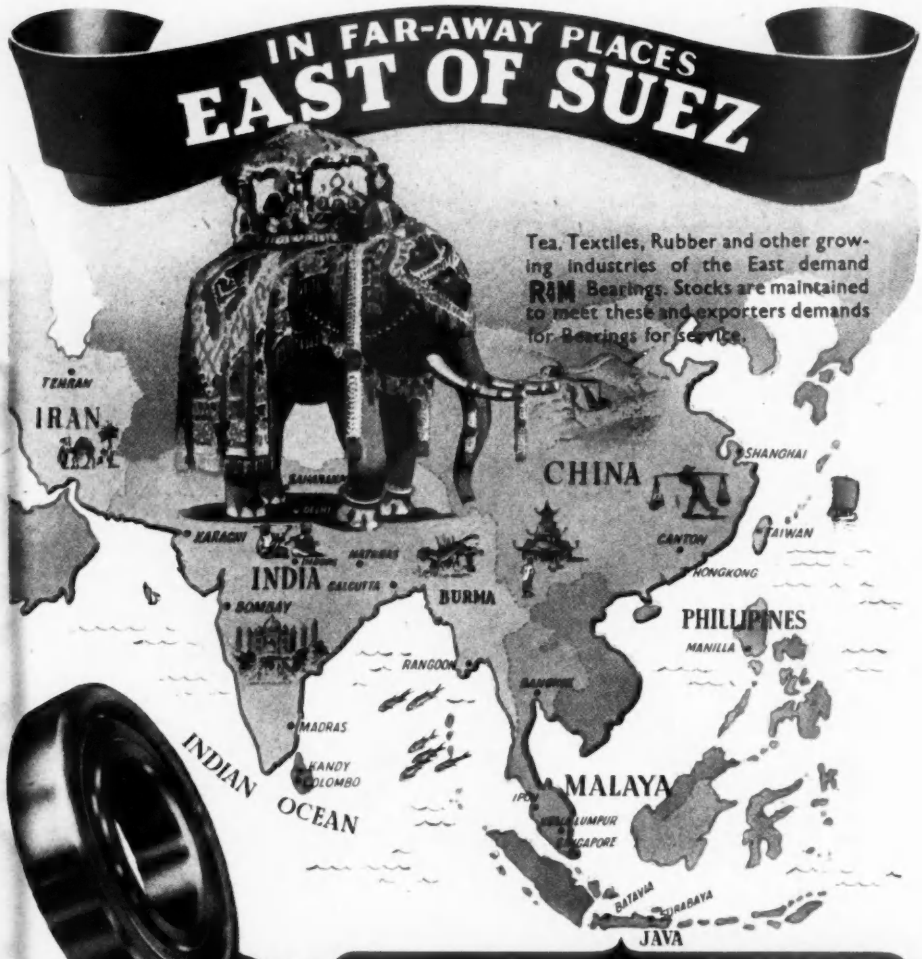

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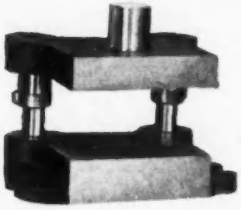

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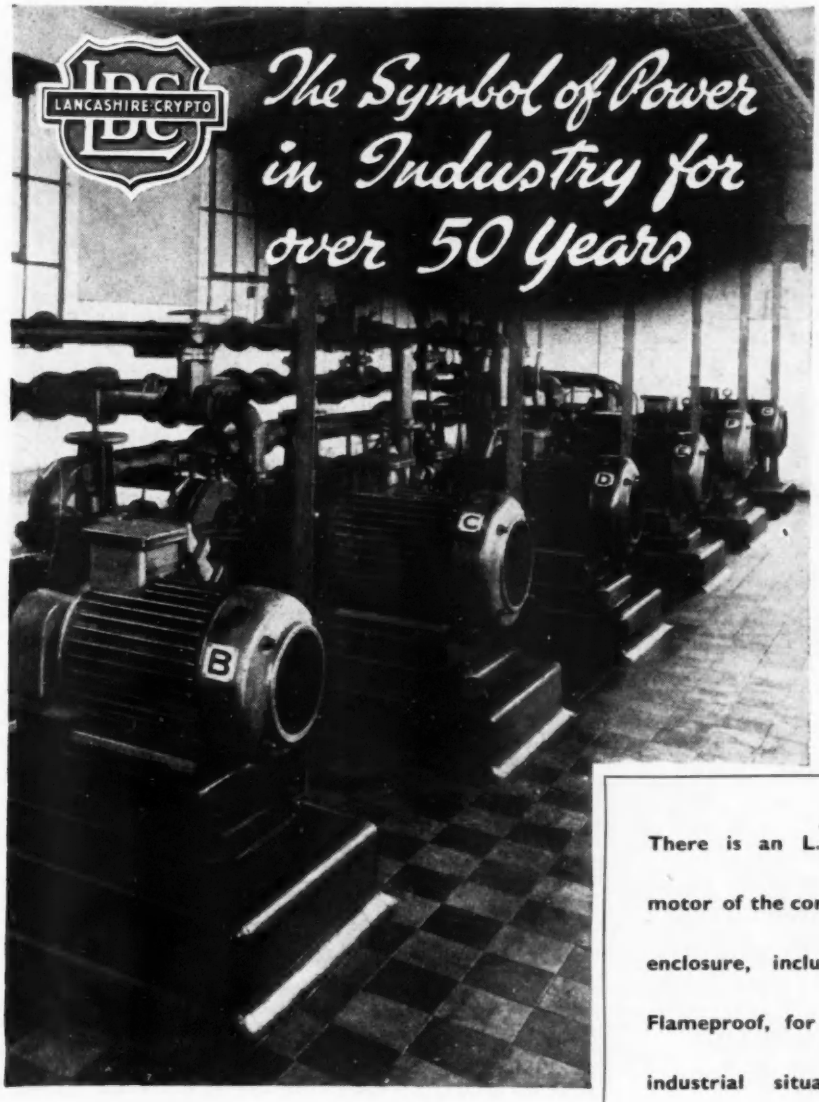

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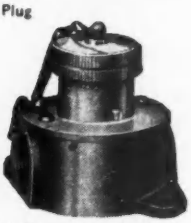

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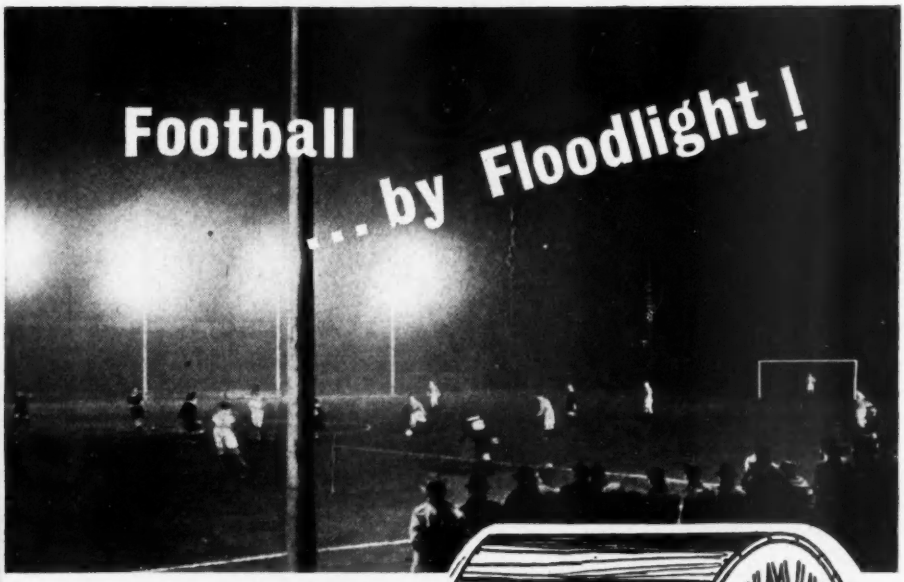

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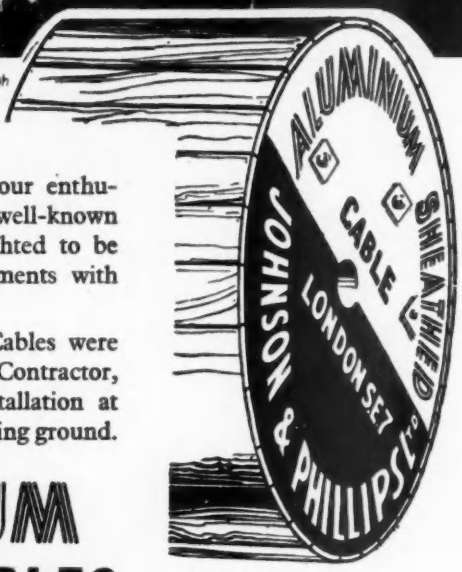

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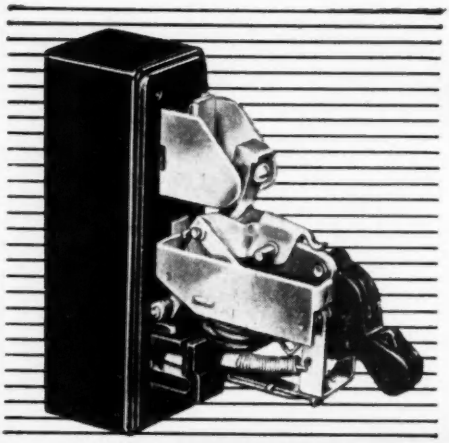

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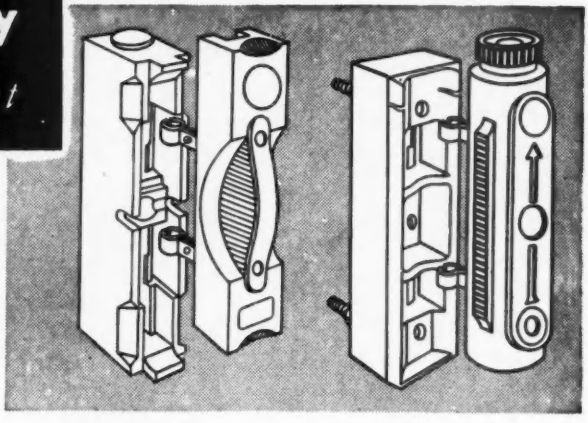

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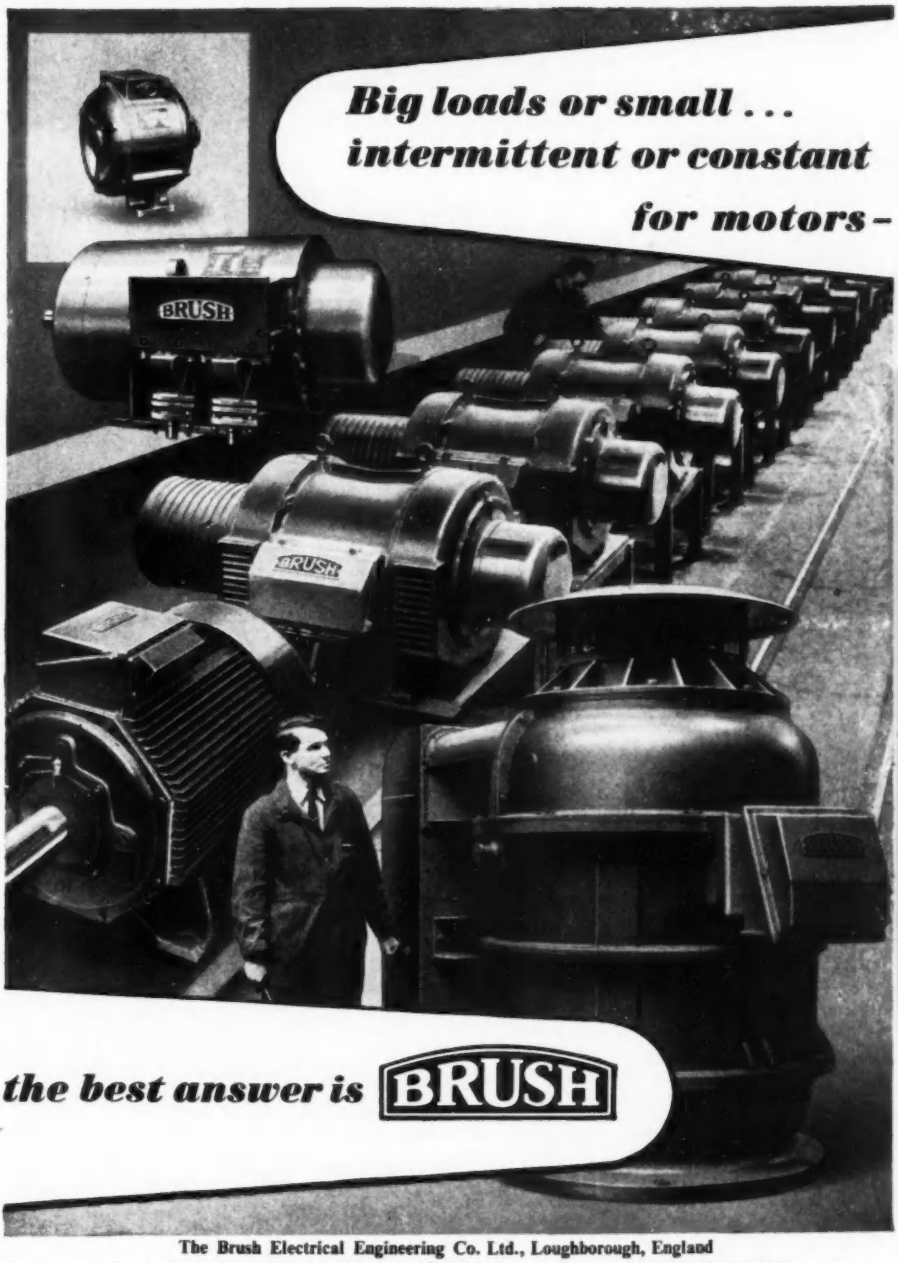

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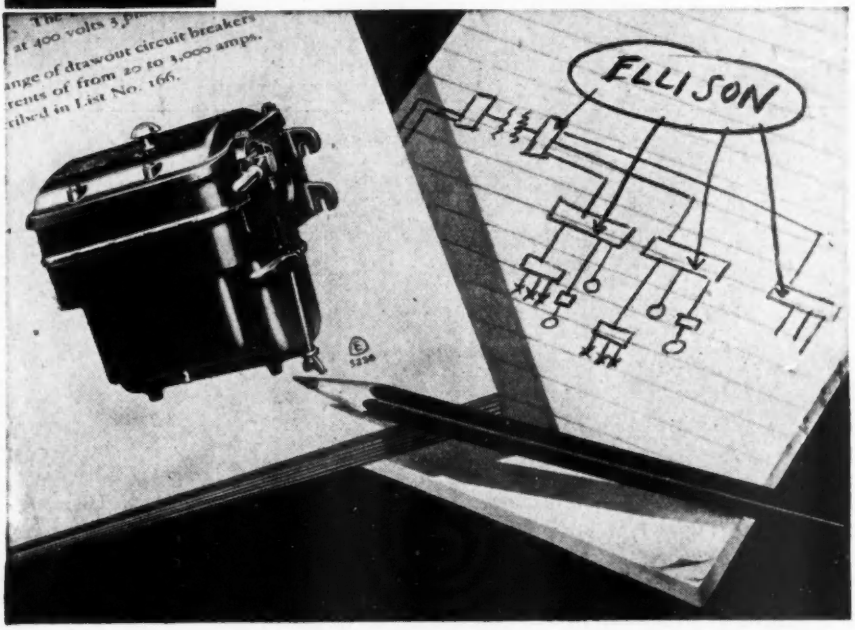

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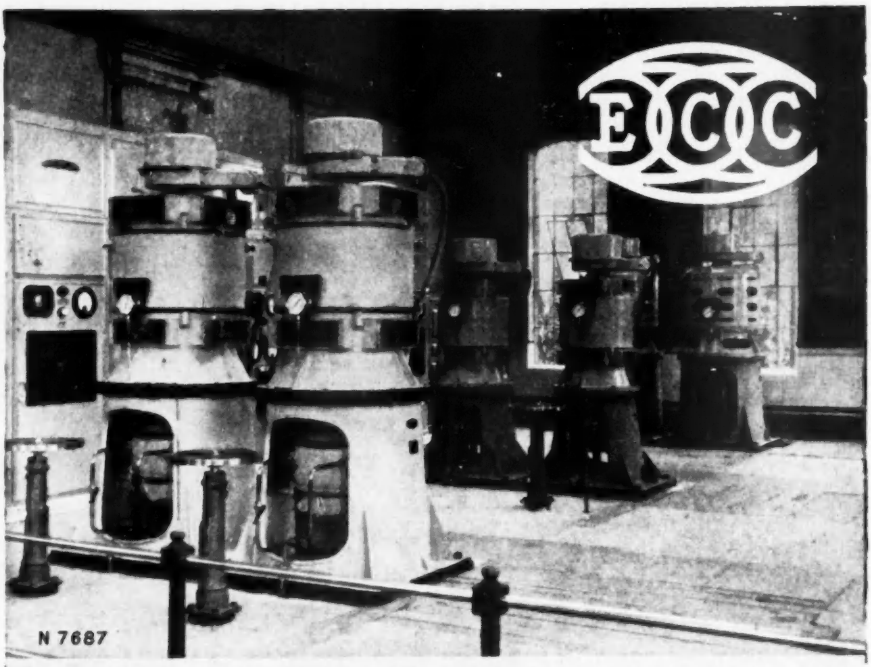

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Editorial

GROWING SHORTAGE

THERE is an unhappy irony in the fact that there has been published this month a report remarking of the calendar year 1949, that there was an appreciable improvement in the availability of material for electrical installation work. At the present time, the shortages and long deliveries familiar in the immediate post-war years seem imminent once more. Both in respect of conduit and of alternative materials, the supply position has swung completely over in a few weeks. Probably, some of the larger contractors, who have the finance and storage space at hand, have been engaging in some private stockpiling, and the effect of this action has been emphasised by the tendency of stocks maintained by wholesalers to be at lower levels because of purchase tax considerations, and of the high cost of goods. Against this, it is quite certain that manufacturers are meeting real difficulties in securing the raw materials for their products. Where the balance lies between these abnormal demands and long term difficulties is uncertain, but there seems little doubt that in a month or so the possession of the requisite building licence is not going to be the determining factor in securing the completion of electrical work.

NATIONAL GAS

PUBLICATION of the first report of nationalised gas holds a nostalgic interest for those in the industry who recall the hard hitting battles of earlier years. The Gas Act, a more recent essay in nationalisation than the 1947 electricity measure, set up a relatively decentralised organisation, but in spite of this there is a similarity between the Gas Council Report and the first B.E.A. document that is characterised by cover designs differing only in the shade of colour used. All the well-learned arguments on allowances for depreciation appear, and the same conclusions are reached. There are the same complaints about the quality of coal, and the same historical review—though this last has a pleasantly naïve touch in its appreciation of electricity competition which, we learn, benefited the gas industry. There is even the same difference in price between north and south, which has been the subject of comment in these columns, though this, as would be expected, occurs to a lesser extent, than in the B.E.A. statistics. Only two touches of the old fight can be found: the gas boards are, naturally, stated to be whole-hearted advocates of freedom of choice in the matter of supplies to the new towns. Most threatening of all, they are at last giving close attention to the avoidance of pressure drops. Might they reach a 6% tolerance before the electrical supply industry reclaims it?

EXPENSIVE ACCURACY

WHEN electronic control gear was first offered to the industrial engineer, the sugar of high accuracy was used to coat the pill of its alleged unreliability and undoubted strangeness. Glowing pictures were painted of speeds held to a fraction of a percent and of immediate response to any change in control. These claims were justified, and there are many duties carried out with the aid of valves and amplifiers that cruder electro-magnetic techniques could not meet. Nowadays, production management and factory electrical engineers have an increased, if still guarded familiarity with electronic equipment, and the convenience of some thyratron and ignitron applications is appreciated for its own sake where accuracy is not of prime importance. In these cases, the manufacturer of electronic gear is plagued with the long-term effect of his earlier propaganda. An example was quoted at the I.E.E. last week where the proposed switch from hand control to an electronic device had been

accompanied by a request for 1% accuracy of speed control, although the previous method had been satisfactory from this point of view. Electronic speed controls incorporating some degree of feed back are likely to be accurate to about 2% even in simple form, but any advance on this figure involves more valves, voltage stabilisation problems and, worst of all, a probable increase in maintenance. Planning engineers will do well to consider carefully their demands in this direction: unnecessary accuracy can be expensive both in first cost and in running expenses.

NO CONCLUSIONS

DISCUSSIONS on the conflict of beauty and convenience in relationship to rural electrification seldom have a calm and satisfactory ending. The acknowledged technical expert, who has proven aesthetic taste, is more likely to produce an acceptable (if unpalatable) conclusion on the matter than any two biased debaters. Such an independent witness is hard to find, but "Meteor" had great hopes of Sir Patrick Abercrombie, who has prepared for the Caernarvon County Council a report on the proposed hydro-electric development in Wales. As expected, an appreciation of the technical difficulties and economic advantages of the scheme is prominent in this document, while the effect on an agricultural economy is carefully weighed. Then comes a change of tempo, with a passionate defence of the natural wildness and untamed beauty of the countryside which, it is feared, the civil engineering works will ruin. But it is disappointing that there is no summing up, no weighing of promised advantages against the loss of elusive amenity. This may arise from the nature of Sir Patrick's terms of reference, but with so much study undertaken, it is a pity that his conclusions are not available.

REWRITTEN RULES

THOUGH mandatory in form, the I.E.E. Wiring Rules seldom have the force of the law behind them as applied to domestic installations. However, when answering queries on installation matters there is the general satisfaction that they are accepted throughout Great Britain as the acme of good practice. A recent article in an American publication has brought a reminder that our transatlantic cousins also have a code—but they lack the unanimity that goes with ours. True to the national genius for doing things in a bigger and better way, some 85% of American cities have local laws specifying the permissible form of domestic electrical installations, and three-quarters of these write in additional clauses departing from the national code. Differences vary from minor points, such as an obstinate insistence on one particular edition of a frequently revised document, to alteration of the requirements so thorough as to qualify as complete rewrites. It is an interesting question whether the over-legislation of the States is more effective than our apparent lack of municipal interest in the subject. Probably the main factor we have to thank for the satisfactory working of a simpler system is the strong position of the I.E.E. as a body fully representative of this country's expert electrical opinion.

COMPLICATING FACTORS

HACKNEY is a power station for which unusual limitations are by no means new. Not so many years ago, when the sole source of cooling water was from the neighbouring canal, the vacuum of the generating set was dependent on the frequency with which barges passed through the canal lock, for every time the gates were opened, there was a marked fall in circulating water inlet temperature. Hackney has expanded since those days, and further extensions are being planned. Additional land is being acquired for the provision of a coal stockyard, but as this will adjoin a public playing field a stipulation has been made by the L.C.C. that the coal stocks must not be drawn upon while games are in progress. It is understood, however, that the above restriction will not be extended to include the new canal-side walk which is being constructed.

Meteor

Economy in Copper

Why not higher conductor ratings for domestic installations?

By T. C. GILBERT, M.I.E.E.

THE threatened copper famine focuses attention yet once again upon the rather extravagant way in which we utilise this material in electrical installations, which should lead to serious considerations of economy. Taking one class of installation alone—that of the local authority housing estate—it is not difficult to suggest several ways in which copper may be saved, without in any way curtailing the services or detracting from efficiency, and as this class of installation probably represents the greatest aggregate in copper conductor consumption today, some suggestions might be discussed with advantage.

The conditions governing the council house installation have changed considerably over the past ten or fifteen years. Then, it was common practice to include a few 2 amp or 5 amp socket outlets in the lighting wiring, ostensibly for portable standard lamps, but which too often enjoyed the favour of a 1 kW or even 2 kW radiator. Some risk might therefore have been involved with any suggestion of cutting down the size of the lighting wiring in those days, but the conditions no longer prevail. In most housing estates the ring-circuit is adopted, with the result that lighting circuits are free of possible overloading, socket outlets being no longer included in their make-up.

It seems, therefore, the height of extravagance to use an already conservatively rated cable as the smallest size permissible for wiring a few lighting points. Small houses cannot demand anything in excess of 100 W at any point, and no final sub-circuit is likely to be ever called upon to deal with more than 2 amps. The runs are short and voltage drop negligible, so that continued insistence upon a 5 amp cable, 1/0·044 or 3/0·029, is clearly unnecessary.

In spite of the concise recommendations in Building Study No. 11, the industry persists in using 3/0·029 cable instead of 1/0·044 wire, and this has a cross sectional area of 0·002 sq in. It is suggested that a new size should be introduced, 0·001 sq in., conveniently in the form of 1/0·036, and which would be ample for the work required of it. This new size would be insulated to present standards, but because of its smaller diameter it would also entail some saving in rubber or p.v.c., neither of which are in good supply at the moment; it could be rated at 3 amps, and thus tie up with the rating of 23/0·0076 flexible cord and the smallest copper fuse link.

With a lighting conductor of only half the present common size, obviously half the copper will be saved, but will this amount to any appreciable quantity? In the average small house installation, with ten to twelve lighting points, some 200 to 250 yds of 3/0·029 cable, representing about 5½ lb of copper, are consumed. The saving per house with this smaller conductor would be some 2½ lb of copper, not in itself a great quantity, but well over one ton in 1,000 such houses. In other words, 1,000 houses could be wired for lighting with the copper at present required for 500 houses.

Mechanical Considerations

Objections will probably be raised on the grounds that this small conductor would be mechanically weak, would break off at loops and connections, and would not stand drawing into conduits, etc. Regarding mechanical strength, it must be remembered that there are many millions of yards of 1/0·036 conductor providing telephone and bell circuits with complete reliability, and often insulated with nothing stronger than a few lappings of cotton. Post Office telephones utilise conductors even smaller, apparently without serious complication with broken connections; the alleged breaking of single-wire conductors is greatly exaggerated, and practically all countries but ours use single conductors in quite large sizes.

In drawing into conduits the smaller conductor has less weight behind it, and is thus subjected to less strain; with smaller overall diameter wall friction with the conduit is less. In any case, the lengths of conduit in small houses are so short that the drawing in of conductors hardly arises—they can all be pushed in. The average electrician would certainly not be nonplussed on this score if asked to wire a few lighting points with our present 3 amp fittings wire. A consequential saving with smaller wires would be smaller conduits also, but this is not at the moment of such serious concern.

It is unlikely that further copper economies in connection with the ring-circuit would be acceptable to many installations engineers, as it is already thought in some quarters that economy in conductor size has already gone too far. Should the War Emergency Relaxations of 1942 be re-imposed, as they could be, then 3/0·036 cables would be re-rated at 15 amps and could be used in place of the present 7/0·029 for ring-circuits, with a saving of one-third the copper. Leaving this point for the moment, however, there is one direction in which further economy is possible in local authority housing—cooker circuits.

Cooker Circuits

As mentioned above, Post-War Building Study No. 11, Electrical Installations, recommends the use of 1/0·044 wires for lighting and 7/0·036 cables for the cooker circuit, in the then-visualised large extension of small house building. In the great majority of housing estates 7/0·044 is specified and installed for cooker circuits, which, with its conservative rating of 38 amps, is a sheer waste of copper. The runs are so short in these small houses that voltage-drop considerations cannot apply, and it is rare to find the cable more than half loaded. The 7/0·036 cable, with its 29 amp rating, is more than ample for small house cooker circuits, and the writer's own 8 kW cooker is wired with this size; in many years of use it has never become appreciably warm, smelled of rubber or burst into flame, and its maximum loading appears to be 16 amps—from which it may be deduced that 7/0·029 cable would have served equally well.

It is therefore suggested that with the proposed economies in connection with lighting and cooker circuits, some 4 lb of copper per house could be saved, say two tons of copper per 1,000 houses—and these houses are going up by the thousand. The writer would go farther and cheerfully accept responsibility for reducing the ring-circuit conductors to 3/0·036, which might mean 2½ tons of copper per 1,000 houses. We are too afraid of these small domestic circuits, not realising the implication of diversity in use; recent checks of ring-circuit loading show averages of 7½ and 9 amps for three- and four-bedroomed houses respectively; there is not the equipment available to demand more. However this may be, there can be no logical objection to the lighting and cooker circuit economies suggested.

The matter of cost has not been considered, as this is relatively unimportant compared with the urgent necessity for conserving copper. With smaller conductors, however, there must be some consequential saving of rubber or p.v.c., neither being too plentiful or cheap today. There might be some manufacturing economy involved with the use of one size of wire only, 0·036 in., in the forms 1/0·036, 3/0·036 and 7/0·036 for lighting, ring-circuit and cooker circuits respectively, which the writer would specify for small domestic installations without a qualm — should regulations permit. This saving of insulation could go much farther with revision of B.S. No. 7/1946, based upon a series of performance tests. The only criterion of a good cable should be performance, as the installation engineer is far less concerned with insulation than with breakdown voltage.

The required dimensions for p.v.c. insulation in B.S. No. 7 have been fixed, apparently arbitrarily, at a round figure above those for rubber insulation, which appears to set an extravagant standard for p.v.c. cables. For instance, p.v.c. has a dielectric strength of 400-500 V per mil, so that a standard 3/0·029 cable with insulation thickness of 1 mm. will have a breakdown voltage of 30 kV; for rubber insulated cables it is in the region of 10 kV.

Why Not?

The writer would be pleased to hear any technical reason why the suggested economies could not be adopted so that the projected 200,000 houses per annum could not show a saving of 400 tons—it might even be 500 tons —of copper over present methods—and without going outside the local authority housing estate. If adopted universally, the saving would be considerably greater, and probably in 50% of installations the smaller conductor would be adequate for lighting. Local conditions would dictate as to how far these economies could be introduced, and for industrial installations attention to power factor correction could save a lot of copper. We have to bear in mind that the choice may eventually be a smaller size of conductor or no conductor at all.

In these days of power cuts and voltage reduction the matter of voltage drop fades into comparative insignificance; it is of little point to budget for 5% drop in the installations if the mains drop is 20%, and once we get back to an all-round 5% drop we shall think we are well served. One has yet to hear that war-time installations are in any way unsatisfactory by comparison with those made under the more extravagant ratings of peace-time, and once again the need arises for coats to be cut according to the cloth available.

Jubilee of London Trams

First Electric tram route in London opened by L.U.T. in April 1901

ALTHOUGH their death knell has sounded and they are fast disappearing from the busy streets of the Metropolis, the trams of London will, at the end of this month, have completed 50 years of efficient service to the Londoner.

It was on April 4, 1901, that the first electric tramway system in London was inaugurated. It ran between Shepherd's Bush and Acton and Shepherd's Bush-Hammersmith and Kew Bridge.

Owned and operated by London United Tramways Ltd., this system was designed and constructed under the supervision of Mr. (later Sir) Clifton Robinson. Plant and wiring was installed by British Thomson-Houston.

It is interesting to note that a six-month delay in opening the line was occasioned by the belief of the Kew Observatory officials that the normal earth-return via the track would interfere with their instruments. The matter was settled after the company had agreed to pay towards the cost of moving the observatory to Teddington.

The hundred cars with B.T.H. traction equipment and open top Hurst Nelson bodies which opened the service were at the time the most luxurious vehicles in London, with lower deck seats covered in tapestry, curtained windows and floor mats. Colour scheme of these first trams was red with white upper works.

On July 6, 1901, an extension was opened from Kew Bridge to Hounslow and four days later the Acton line was extended to Southall. On this occasion the inauguration of the line was formally celebrated. A party of distinguished visitors, including Mr. A. J. (later Earl) Balfour), were taken on an inaugural run to Southall in ten of a further fifty cars which had just been added to the L.U.T. fleets. They had Milnes bodies with Westinghouse equipment with all cream livery.

Further extensions were numerous in the next few years: 1902 saw the opening of services to Twickenham and Richmond Bridge; in 1903 this was extended to Hampton Court round both sides of Bushy Park. At this time a further 150 cars were added; these had powerful Westinghouse traction motors and bodies by various makers. They were painted blue with white upperworks.

Following closely upon these extensions came further routes to Brentford, Hanwell, Kingston Ham, the Dittons and Tolworth, whilst one pushed eastwards to Tooting. A further 40 cars of a new design were purchased; which had full-length upper decks and covered tops, the bodies being by the United Electric Car Co. with Westinghouse equipment.

In 1907 the system was complete, route mileage amounting to 55¼ miles with about 300 cars. However, various sections were abandoned or handed to other authorities later so that the system inherited by the London Passenger Transport Board in 1933 was not so great.

Despite many changes of control, the L.U.T. in the final years before absorption into the L.P.T.B., being controlled by British Electric Traction and the Underground Group, the company remained a very progressive undertaking. For not only did the L.U.T. inaugurate the first electric tram route in London, but they introduced the first London trolleybus route in May, 1931, and in common with Metropolitan Electric Tramways, with whom they were associated, they introduced the 140 h.p. front exit "super" trams—the U.C.C. type "Feltham" trams, most of which have been sold by London Transport and are beginning new life in Leeds.

Other innovations included a single deck tram equipped with tables and luxurious seating for private hire work, "pay as you enter" one-man trams and, in 1933, a forward entrance 74-seater trolleybus.

No part of this former L.U.T. system is operated by trams today, it being converted to trolleybus operation between 1931 and 1935.

Top. The ceremonial run to Scuthall in 1901; right, "open" tram of 1902 and below, the final phase, the U.C.C. "Feltham" type car

Hydro Power

—The Orrin Scheme in SCOTLAND

YET another power scheme has been published by the North of Scotland Hydro-Electric Board. Called the Orrin project (constructional scheme No. 29), it will develop the water power of the River Orrin in Ross-shire to generate 18,000 kW, and an annual output of approximately 74 million units.

This Orrin scheme is the third stage of a group of projects in the basin of the River Conon which will have six generating stations and seven main dams. Thus, the combined capacity of the stations of the Conon Basin group will be about 107MW, with an annual output of about 442 million units. The first stage, the Fannich scheme, went into operation last November. The second stage is the Glascarnoch-Luichart-Torr Achilty scheme upon which work has just started.

In the new Orrin scheme, the proposed works include a new loch to be formed in Glen Orrin, five miles upstream from the Orrin Falls, by the construction of a dam 120 ft high and 972 ft long across the River Orrin. The new loch will be fed from a catchment area of 54 sq miles, with an average rainfall of about 68 in.

From the loch, water will be taken by a tunnel to Orrin generating station in Strathconon, near Achonokie, on the southern shore of the loch to be formed by the new Torr Achilty dam, which is part of the previously noted Glascarnoch-Luichart-Torr Achilty scheme. Water discharged from the Orrin power station will therefore be again utilised in passing through the Torr Achilty turbines and a further five million units per annum will be gained in this way. Cost of the scheme is estimated at £3,500,000.

—and a Report on N. WALES

JUSTIFICATION for the British Electricity Authority in considering all possible resources of additional power, is expressed in the report of Professor Sir Patrick Abercrombie on the hydro-electric power schemes in North Wales. His report, issued last Thursday, was made at the request of the Caernarvonshire County Council. That county, he claims, stands to gain or lose more by the schemes than any other in the region affected, for, although ten of the proposed twenty power stations will be located within its area, it is the necessary accompaniments, such as reservoirs, leets, tunnels, pipelines, pylons, cables, etc., which will have a greater impact upon the mountain landscape of the area.

It is accepted that a supply of electricity is a necessity of modern life. Anything that can help forward (*a*) rapid distribution, (*b*) cheap cost and (*c*) a sufficient quantity of power, should be warmly welcomed provided these could be realised without corresponding drawbacks. Sir Patrick points out that in spite of the considerable physical difficulties, the west area of North Wales is reasonably well advanced in its main distribution system, and especially Caernarvonshire. One reason for this, was the existence of early local hydro-electric stations. The Merseyside and North Wales Electricity Board had also prepared a plan under which nearly every country cottage and farm would eventually have its supply, but this would take at least 15 years to complete.

After giving estimates of the cost of the new power schemes—about £30 million—he refers to fears that, on capital grounds, distribution might be slowed down to speed work on the hydro-electric schemes. The same money spent on transmission lines and local electrification might well supply the Welsh farmer and country industrialist with power in a comparatively few years. Consideration is then given to alternative methods of obtaining the 500 million kWh expected from the hydro-electric stations. The new Connah's Quay 180 MW station might be run at 80% load factor, or alternatively a further 80-100 MW steam station could be erected within the area—but the related technical questions he has placed outside the scope of the report, while emphasising that it would be hazardous to attempt a comparison of costs of generation from coal and water power.

But the vital problem in the rural counties of Wales, it is stressed, is that of distribution—nothing must be allowed to interfere with the essential expenditure on such work.

A considerable part of the report is, of course, devoted to the amenity aspect of the proposals, the definition of a national park being quoted as "an extensive area of beautiful and relatively wild country in which . . . the characteristic landscape is directly preserved. . . ." A vigorous general local life is essential if the area is not to become a topographical or geological museum. After referring more specifically to the impact of the sections of the schemes upon the territory, Sir Patrick points out that the North Wales area is small compared with Switzerland or Northern Scotland, making comparison mis-leading. What there may be absorbed in North Wales becomes dominating and destructive of the landscape. The three earlier hydro-electric schemes were not sufficient to tilt unduly the balance of a prevailing wild area suitable for the creation of a National Park; the present proposals upset the balance altogether, he avers.

This report is to be considered by the County Council at a special meeting on April 2.

Double Ratio Current Transformers

Ratio and phase angle errors are complex functions of series/parallel connections

By A. A. HALACSY, D.Sc.(Eng.), A.M.I.E.E.

DOUBLE ratio CT's are often composed of two equal CT's, the interconnection of which may be changed from "series" to "parallel," this arrangement permitting the most frequently required (1 : 2) change of ratio.

The cases *b*, *c*, *d* and *e* in Table 1 show the four possibilities of such series-parallel connections. The case *a* is included in order to have a "datum," and to enable the reference to each of the two CT's as individuals.

TABLE I. Possible Winding Connections

Case	Primaries	Secondaries
a	independent	independent
b	series	series
c	series	parallel
d	parallel	parallel
e	parallel	series

In the following consideration the two CT's called *A* and *B* are supposed to have identical iron cores and turn-numbers, i.e.:

$$t_{1A} = t_{1B} = t_1 \; ; \quad t_{2A} = t_{2B} = t_2$$
$$A_A = A_B = A \; ; \quad l_A = l_B = l$$

Any series of parallel connection of two identical CT's alters the nominal ratio K_n and the turn ratio K_t in the same proportion; consequently the percentage turn-ratio error $\varepsilon_t = 100\ (K_n - K_t)/K_n$ remains the same in such combinations.

The phase-angle of the internal and external burden is supposed to have a constant value. This approximation results in a simple calculation and no major errors, at least in most of the practical cases. The total external burden VA_{ex}, the total full load current I_2 of the complete combination and the internal burden VA_{in} of each CT are assumed to keep their values.

The errors of a CT are calculated from the magnetising current, usually referred to the secondary side by dividing the primary values by the turn-ratio. The full load current in the secondary is usually the same in CT's of different turn-ratios and is therefore suitable for use as a common base.

The aim of the present article is to work out and tabulate those converted values of the magnetising current and to survey the changes

LIST OF SYMBOLS

Z = Impedance of burden, ohm.
VA_{ex} = Voltamps of the whole external burden at the nominal amperage.
VA_{in} = Voltamps of the internal burden of one CT at the nominal amperage.
E = Voltage, r.m.s.
I = Amperage, r.m.s.
I_m = Magnetising, i.e. reactive-component of the magnetising current, amps r.m.s.
I_w = Loss, i.e. watt-component of the magnetising current, amps, r.m.s.
w = Watt-loss per pound of the iron core.
A = Cross sectional area of the iron core, sq in.
l = Mean length of the iron core, inches.
W = Weight of the iron core, pounds.
t = Number of turns.
K_n = Nominal ratio of the CT.
K_t = t_2/t_1 turn ratio of the CT.
B = Magnetic induction, Gauss, r.m.s.
H = Magnetising force, Oersted, r.m.s.
C = Constant

Subscripts:

1 = Primary.
2 = Secondary.
A = Related to the CT, noted with A.
B = Related to the CT, noted with B.
in = Internal.
ex = External.
a, *b*, *c*, *d*, *e* = Refer to the connections detailed in Table I.

in errors which may be expected in such combined (series-parallel) CT's.

Single CT.

Consider first a single CT quite independent from any other. The magnetic induction B_a inducing E_{2a} e.m.f. into the secondary winding in order to force I_2 amps through all the secondary burden (including the external burden connected to the secondary terminals and the internal burden of the CT itself as well) may be calculated from the usual transformer equation

$$B_a = CE_{2a}/t_2A \quad \ldots\ldots(1)$$

The secondary total e.m.f. E_{2a} can be split into two components, one of these overcoming the external and the other the internal burden

$$B_a = C(E_{2ex}+E_{2in})/t_2A = C(VA_{ex}+VA_{in})/t_2AI_2 \quad \ldots\ldots(2)$$

The value of the corresponding magnetising force H_a and that of the watt-loss W_a may be taken from the magnetising curve and watt-loss curve of the iron used. The pure magnetising and the watt-loss components of the magnetising current referred to the secondary side are

$$I_{ma2} = 1{\cdot}44\ l\ H_a/t_2 \quad \ldots\ldots(3)$$

$$I_{wa2} = w_a\ W/E_{2a} \quad \ldots\ldots(4)$$

Series/Series

The resulting nominal ratio as well as the resulting turn-ratio is in the case of series primary/series secondary obviously the same as has just been considered.

The e.m.f. E_{2bex} forcing I_2 amps through the *external* burden is shared equally by the two CT's being connected in series. The e.m.f. E_{2bin} overcoming the *internal* burden must be in *each* CT the same as in the case (a) because the CT's and their secondary current I_2 are the same. The e.m.f. of the whole combination, i.e. of the two series connected CT's together is accordingly

$$E_{2b} = E_{2ex} + 2E_{2in} \quad \ldots\ldots(5)$$

The two CT's are sharing E_{2b} equally

$$E_{2Ab} = E_{2Bb} = (E_{2ex}/2) + E_{2in} = (VA_{ex}/2I_2)+(VA_{in}/I_2) \quad \ldots\ldots(6)$$

$$B_b = CE_{2Ab}/t_2A = C\,[(VA_{ex}/2)+VA_{in}]/t_2AI_2 \quad \ldots(7)$$

Let

$$VA_{in}/(VA_{ex}+VA_{in}) = b \quad \ldots\ldots(8)$$

A short calculation proves (Appendix I)

$$E_{2b} = (1+b)E_{2a} \quad \ldots\ldots(9)$$

$$E_{2Ab} = \frac{1+b}{2}\,E_{2a} \quad \ldots\ldots(10)$$

$$B_b = \frac{1+b}{2}\,B_a \quad \ldots\ldots(11)$$

Usually B_b has a value between B_a and $B_a/2$ because the internal burden is usually less than the external one.

H_b can be read from the magnetising curve. The pure magnetising current passes through the two series-connected primaries. Its value referred to the secondary side is

$$I_{mb2} = 1{\cdot}44\ l\ H_b/t_2 \quad \ldots\ldots(12)$$

Usually I_{mb2} is less than I_{ma2}.

The watt-loss per pound $W_{Ab} = W_{Bb}$ can be read from the watt-loss curve against B_b. The total watt loss of the whole combination is the sum of the watt losses of both CT's, i.e., the double of the watt loss of one CT.

$$w_b = 2w_{Ab}\ W \quad \ldots\ldots(13)$$

The corresponding watt component of the magnetising current converted to the secondary side is

$$I_{wb2} = 2w_{ab}W/E_{2b} = 2w_{Ab}W/(1+b)E_{2a} \quad \ldots\ldots(14)$$

Combining equations (14) and (4)

$$I_{wb2} = I_{wa2}\cdot w_{Ab}/w_a\ \frac{1+b}{2} \quad \ldots\ldots(15)$$

The watt-loss per pound of the usual types of iron used in CT's, e.g. Stalloy, Permalloy,

TABLE 2. Values of Burden Ratios

b	=	1·0	·9	·8	·7	·6	·5	·4	·3	·2	·1	0
(1 + b)/ 2	=	1·0	·95	·9	·85	·8	·75	·7	·65	·6	·55	·5
1 — b/2	=	·5	·55	·6	·65	·7	·75	·8	·85	·9	·95	1·0

Mumetal, varies approximately with the square of the magnetic induction within the usual operating range. (See Appendix II.)

$$\frac{W_{Ab}}{W_a} = \left(\frac{B_b}{B_a}\right)^2 = \left(\frac{1+b}{2}\right)^2 \quad \ldots\ldots(16)$$

In such cases

$$I_{wb2} = I_{wa2}\ \frac{1+b}{2} \quad \ldots\ldots(17)$$

Some values of b and $(1+b)/2$ are shown in Table 2.

Series/Parallel

When the primaries are connected in series and the secondaries in parallel, the secondary current I_2 keeps its value if the external burden remains the same. I_2 is shared equally by the two CT's one of them contributing $I_2/2$. Accordingly, the nominal ratio drops to the half of that of the case (*a*).

$$K_{nc} = I_2/2\ I_1 = K_{na}/2 \quad \ldots\ldots(18)$$

The turn ratio results in a similar expression.

$$K_{tc} = t_{2A}/2t_1 = t_{2B}/2t_1 = K_{ta}/2 \quad \ldots(19)$$

The e.m.f. overcoming the external burden must be the same. The two secondaries being paralleled

$$E_{2cex} = E_{2Acex} = E_{2Bcex} = E_{2ex} = VA_{ex}/I_2 = I_2 Z_{ex} \quad \ldots\ldots(20)$$

The internal impedance Z_{in} of each CT is unaltered. Half of the total current flows through one CT and requires the half of the voltage to push it through, compared with the previous cases (*a*) and (*b*).

$$E_{2cin} = E_{2Acin} = E_{2Bcin} = Z_{in} \cdot I_2/2 = VA_{in}/2I_2 = E_{2ain}/2 \quad \ldots\ldots(21)$$

The total e.m.f. in each of the two paralleled CT's, i.e. in the whole combination is the sum of the voltages wanted to overcome the external and internal burden and given in equations (20) and (21).

$$E_{2c} = E_{2Ac} = E_{2Bc} = E_{2cex} + E_{2cin} = E_{2ex} + E_{2in}/2 = VA_{ex}/I_2 + VA_{in}/2I_2 = (VA_{ex} + VA_{in}/2)/I_2 \ldots(22)$$

Comparing E_{2c} with E_{2a} and proceeding as in case (*b*)

$$E_{2c} = E_{2Ac} = E_{2Bc} = (1-b/2)\, E_{2a} \ldots(23)$$

$$B_c = (1-b/2) B_a \ldots\ldots(24)$$

H_c can be read again from the magnetising curve. The magnetising current in the *primary* of each CT is

$$I_{mAc1} = I_{mBc1} = 1{\cdot}44\ l\ H_c/t_1 \ldots\ldots(25)$$

This *primary* value must be divided by the resulting $t_2/2t_1$ turn ratio in order to refer it to the secondary side of the whole combination. The result of this conversion is

$$I_{mc2} = 2.1{\cdot}44\ l\ H_c/t_2 = 2I_{mAc2} = 2I_{mBc2} \ldots(26)$$

Usually the value of B_c is between those of B_a and $B_a/2$ and the value of the magnetising component I_{mc2} is between I_{ma2} and $2I_{ma2}$, and closer to the latter one in the most cases.

The watt-loss per pound $W_{Ac} = W_{Bc}$ is read from the watt-loss curve. The watt-loss components of the magnetising current of each CT are in the primary

$$I_{wAc1} = I_{wBc1} = w_{Ac}\ W/E_{1c} \quad \ldots\ldots(27)$$

Proceeding as in case (*b*).

$$\frac{W_{Ac}}{W_a} = \left(\frac{B_c}{B_a}\right)^2 = \left(1-\frac{b}{2}\right)^2 \quad \ldots\ldots(28)$$

Converting the secondary voltages given in equation (23) to the primary side

$$E_{1Ac} = E_{1Bc} = \left(1-\frac{b}{2}\right) E_{1a} \ldots\ldots(29)$$

Combining equations (27), (28) and (29),

$$I_{wAc1} = I_{wBc1} = w_a W \left(1-\frac{b}{2}\right)/E_{1a} = I_{wa1}\,(1-b/2) \ldots\ldots(30)$$

Proceeding in a manner corresponding to that used for the magnetising component, the watt-loss component of the whole combination and converted to the secondary is

$$I_{wc2} = 2(1-b/2) I_{wa2} \ldots\ldots\ldots\ldots(31)$$

The value of I_{wc2} is usually close to the double value of I_{wa2}.

Some values of $(1-b/2)$ are included in Table 2.

Parallel/Parallel

The nominal ratio and the turn ratio are obviously the same as in the case (*a*).

$$K_{nd} = K_{na} \ ; \ K_{td} = K_{ta} \ldots\ldots\ldots(32)$$

The burden and the secondary connection being the same as in the case (*c*), the e.m.f.-s magnetic induction and magnetising force are the same too. Consequently

$$I_{mAd1} = I_{mBd1} = I_{mAc1} = I_{mBc1} \ldots(33)$$

The primaries are paralleled and there follows

$$I_{md1} = 2I_{mAd1} = 2I_{mAc1} = 2I_{mBd1} = 2I_{mBc1} \ldots(34)$$

Converting this value to the secondary side, i.e. dividing by the turn-ratio

$$I_{md2} = 2I_{mAc1} t_1/t_2 = I_{mc2} \ldots\ldots\ldots(35)$$

Quite similar is the situation regarding the watt-loss component which is (see equation 30)

$$I_{wAd1} = I_{wBd1} = I_{wAc1} = I_{wa1}(1-b/2) \ldots(36)$$

$$I_{wd2} = 2\,(1-b/2)\, I_{wa2} \ldots\ldots\ldots\ldots(37)$$

Parallel/Series

The secondary amps are the same as in the case (a), the primary amps are shared between the two CT's. Consequently the nominal ratio as well as the turn-ratio is doubled

$$K_{ne} = 2\ K_{na} \ldots\ldots\ldots\ldots(38)$$

$$K_{te} = 2\ K_{ta} \ldots\ldots\ldots\ldots(39)$$

The secondaries being in series, the secondary e.m.f., the magnetic induction and the magnetising force are the same as in case (*b*). The pure magnetising component of the primary magnetising current is in *each* primary

$$I_{mAe1} = I_{mb1} = 1{\cdot}44\ l\ H_b/t_{1a} \ldots\ldots(40)$$

The primaries being paralleled, the primary magnetising component of the whole combination is

$$I_{me1} = 2I_{mAe1} \ldots\ldots\ldots\ldots(41)$$

Converting this value to the secondary side and combining it with equations 39 and 40.

$$I_{me2} = 2I_{mAe1}/K_{te} = I_{mb1}/K_{ta} = I_{mb2} \ldots(42)$$

The primary watt-loss current of one CT is similarily

$$I_{wAe1} = w_{eA}W/E_{1bA} = w_{ta}W/\left(E_{2bA}\frac{t_1}{t_2}\right) = \frac{1+b}{2}I_{wa1} \quad \ldots\ldots(43)$$

For the complete combination

$$I_{we1} = (1+b)I_{wa1} \quad \ldots\ldots(44)$$

Converting to the secondary side

$$I_{we2} = I_{we1}/K_{te} = I_{we1}/2K_{ta} = \frac{1+b}{2}I_{wa2} \ldots(45)$$

Table 3 shows the result of the above calculations. The series-parallel connection of identical CT's alters the ratio in 1:2, 1:1, or 2:1. The pure magnetising current and the watt-loss is altered depending on the ratio of the internal and external burden. Consequently the ratio-error and the phase-angle-error are not simply halved, maintained or doubled in such combinations but follow the alterations in the pure magnetising and the watt-loss current given in Table 3.

APPENDIX 1

From eq. (2)

$$E_{2a} = (VA_{ex}+VA_{in})/I_2 \quad \ldots\ldots(7a)$$

From eq. (6)

$$E_{2Ab} = (VA_{ex}/2+VA_{in})/I_2 \quad \ldots\ldots(7b)$$

$$\frac{E_{2Ab}}{E_{2a}} = \frac{VA_{ex}/2+VA_{in}}{VA_{ex}+VA_{in}} = \frac{1}{2}\frac{VA_{ex}+2VA_{in}}{VA_{ex}+VA_{in}} = \frac{1}{2}\frac{VA_{ex}+VA_{in}+VA_{in}}{VA_{ex}+VA_{in}} = \frac{1}{2}\left(1+\frac{VA_{in}}{VA_{ex}+VA_{in}}\right) = \frac{1}{2}(1+b) = \frac{1+b}{2} \quad \ldots\ldots(7c)$$

$$E_{2Ab} = \frac{1+b}{2}E_{2a} \quad \ldots\ldots(7d)$$

$$E_{2b} = 2E_{2Ab} = (1+b)E_{2a} \quad \ldots\ldots(7e)$$

APPENDIX II

The curve of the watt-loss per pound against the magnetic induction is very near a straight line in a two-way logarithmic scale, for the normal types of iron and in the usual range of operation.

$$log\ w_a - log\ w_b = K\ (log\ B_a - log\ B_b)$$

$$\frac{W_a}{W_b} = \left(\frac{B_a}{B_b}\right)^K$$

The average of k, measured from such graphs is k=1·985, i.e. approximately 2, giving

$$\frac{W_a}{W_b} = \left(\frac{B_a}{B_b}\right)^2 = \left(\frac{1+b}{2}\right)^2 \quad \ldots\ldots(16)$$

TABLE 3—Summary of results for various winding connections

	a	b	c	d	e
Primaries	separate	series	series	parallel	parallel
Secondaries	separate	series	parallel	parallel	series
$K_t=$ $K_n=$	$K_{ta}=t_2/t_1$ K_{na}	$K_{ta}=t_{2A}/t_{1A}$ K_{na}	$K_{ta}/2$ $K_{na}/2$	K_{ta} K_{na}	$2K_{ta}$ $2K_{na}$
$E_2=$	$E_{2a}=\frac{VA_{ex}+VA_{in}}{I_2}$	$(1+b)\,E_{2a}$	$\left(1-\frac{b}{2}\right)E_{2a}$	$\left(1-\frac{b}{2}\right)E_{2a}$	$(1+b)\,E_{2a}$
$E_{2A}=E_{2B}=$	E_{2a}	$\frac{1+b}{2}E_{2a}$	$\left(1-\frac{b}{2}\right)E_{2a}$	$\left(1-\frac{b}{2}\right)E_{2a}$	$\frac{1+b}{2}E_{2a}$
$B_A=B_B=$	B_a	$\frac{1+b}{2}B_a$	$\left(1-\frac{b}{2}\right)B_a$	$\left(1-\frac{b}{2}\right)B_a$	$\frac{1+b}{2}B_a$
$I_{mA1}=I_{mB1}=$	I_{ma1}	Usually considerably less than I_{ma1}	Usually somewhat less than I_{ma1}	$2I_{mAC1}$	$2\,I_{mAb1}$
$I_{m2}=$	I_{ma2}	$I_{mb2}=$ Usually considerably less than I_{ma2}	$2\frac{t_1}{t_2}I_{mAC1}=$ Usually nearly double I_{ma2}	I_{mc2}	I_{mb2}
$I_{wA1}=I_{wB1}=$	I_{wa1}	$\frac{1+b}{2}I_{wa1}$	$\left(1-\frac{b}{2}\right)I_{wa1}$	$\left(1-\frac{b}{2}\right)I_{wa1}$	$(1+b)\,I_{wa1}$
$I_{w2}=$	I_{wa2}	$\frac{1+b}{2}I_{wa2}$	$2\left(1-\frac{b}{2}\right)I_{wa2}$	$2\left(1-\frac{b}{2}\right)I_{wa2}$	$\frac{1+b}{2}I_{wa2}$

Our readers' views . . .

Service Centres

YOUR interesting leader in the issue of March 8 on "Service Centres" affords much food for thought. I suggest that the large statistical branch of the Head Office of the B.E.A. might well make a survey of the present position in the various Area Boards on the lines you suggest and that this would be of value to Area Boards in reviewing their policy. Extravagance in service centres has to be paid for out of the pockets of the consumers.

The survey might include an estimate of the influence of service centres in keeping down prices. In most cases, so far as my experience goes, normal competition is adequate without service centres but not in every case. London presents a case by itself. Many of the service centres are remnants of the old plethora of supply undertakings. Many could be closed with advantage.

The London Electricity Board should make a thorough survey at once, close many, and improve such as are retained. This economy resulting from amalgamation has apparently escaped attention.

THE ATHENAEUM *Waley Cohen*

Engineers Wanted

THERE can be no doubt that the basic problem of the inadequate supply of graduate engineers is tied up with the general level of salaries offered and the following facts are, I suggest, worthy of serious consideration.

1. The I.E.E. have, since 1945, gone to great lengths to formulate clear definitions of the Professional Electrical Engineer and the Electrical Technician, with the object of maintaining the status of the chartered engineer whilst at the same time establishing a definite intermediate class of person to be known as an electrical technician.
2. An examination of the reports of the Joint Committee on Practical Training in the Electrical Engineering Industry indicates that the committee consider the Supply Industry has the need of both professional engineers and electrical technicians; broadly, the technicians place is to undertake work of a specialised character or act as assistant to a professional electrical engineer.
3. The B.E.A. and Area Boards have not made the slightest practical endeavour to recognise these distinctions with the result that they are anxious to fill *any* engineering position with a graduate or professional engineer (as a preference), although the salary offered is, in most cases, appropriate to that of an electrical technician.
4. The British Electricity Safety Rules (June, 1950) "define" Authorised Persons and Senior Authorised Persons, but give no indication whether either are expected to be of status equivalent to professional engineers.

In conclusion it must be stressed that whilst the Electricity Authority continue to advertise responsible engineering positions at salaries of £500-£600 p.a. (equivalent to £250-£300 p.a. in 1939, let it be noted), the present vicious circle will remain and the intake of graduate engineers will progressively diminish.

HAMPSHIRE *W.A.J.*

Trouble with Fluorescents

IN this area the mains voltage has at times been very low, and has caused tremendous trouble with fluorescent lighting.

To overcome this I installed fittings with the choke and the condenser in series. The installation was of screwed conduit, having five fittings on a circuit with a 5 amp switch, quick make and break controlling each circuit.

The system was quite successful from the point of view that the flickering was stopped, even when the voltage dropped from 230 V to 190 V, but when the voltage was normal several circuits would fuse when switched off. On inspection it was found that the current had jumped from the 5-amp switch to earth in every case. The immediate cure was to fit 150,000 ω resistances from the dead side of the switches to earth to ensure discharge of the condensers.

From this experience it would appear that if the chokes and condensers are arranged in the above fashion, it would be policy to restrict the number of fittings to three per 5-amp switch, or use 15-amp switches.

In passing, it should be noted that the condenser was fitted by the manufacturer with the normal leak across it, but it was evident that this was insufficient. It was also noted that the lamp ends were often badly burnt. This was, of course, due to weak springing at the holders, but burning would not have occurred had the condenser discharge had an easier path back to the neutral.

Comments would be much appreciated.

NORWICH *G.R.T.*

Notes on Wiring
by MEGOHM

Forward Planning

Some problems on future requirements

DURING a recent discussion with an engineer concerning some fairly large installations for some new buildings in course of erection on which he was engaged, he remarked upon the changes in requirements which have taken place during the last 20 years or so. We also fell to wondering what the next 20 years will bring about; and this is a matter of some importance, as the life of a modern installation should exceed this span of time without becoming totally out of date, or unsuitable for further useful service.

With the seemingly never ending rise in costs, the man who foots the bill naturally exercises his right to decide when his limit has been reached, and it is the moral responsibility of those who are paid to advise him to ensure that he gets the best value for the money expended. It is probably true to say that nothing was ever done by man which could not be improved upon, but in our particular walk of life we must always aim at the happy medium which will at least be sufficient for most practical purposes.

Bulk Supply

With a modern type of installation in a building of six to eight floors, loadings of 200-400 kW are not uncommon, with the result that in any large city the medium voltage network is quite unable to cope with the load, and provision must therefore be made for a transformer chamber and the associated gear. Having duly arranged for this, the next problem is the internal distribution in the building, and how best to arrange the switchroom, metering and rising mains.

The main switchroom usually presents no great difficulty, but the metering, for several reasons, invariably does, and until the metering arrangements have been decided upon, the mains layout cannot be completed or even considered. The chief difficulty usually is that the premises may at some time be occupied by only one consumer, and at some other date it may contain a large number of different firms, each having its own particular requirements. In each event a certain amount of segregation of the wiring will be necessary, unless an attractive all-in tariff is available and one consumer only can be guaranteed.

I sometimes wonder why the supply authorities have not developed the system of selling in bulk to the owner of large premises and let him retail the energy at such terms as he may consider equitable, somewhat on the "fixed price light" system. The advantages of this method seem to be many, and if a landlord provides heating for a building as an item in the rental or as an extra, I see no real reason why lighting could not be dealt with on somewhat similar lines. No question of commercial dishonesty or unsocial activity need arise.

Rising Mains

Our discourse then turned to the internal mains distribution, and we agreed that in all cases where a scheme to meet all foreseeable contingencies cannot be provided, then space for later additions is an absolute essential.

This tariff question is really the crux of the whole matter, for in lofty buildings one frequently finds the motors for the lifts and ventilating plant at the top of the building and the supply for these is a "landlord's service," Similarly, where firms have canteen facilities on the premises, the top floor is often chosen as the most suitable for the purpose, thus adding a comparatively heavy load at the most distant point of the installation, and usually charged at a different rate or separately metered for accounting purposes.

In one installation, fortuitously on an all-in rate, a considerable saving in copper and subcircuit wiring was effected by running two sets of 4-core risers, one for the east side and the other for the west side, of a rectangular building, and joining them up in the form of a ring main. The risers followed the two lift shafts to the top of the building, and at that point each fed a lift-room with two 25 h.p. motors. The two lift-rooms were inter-connected by means of a horizontal main following a central corridor, and the ventilating plant and canteen were picked up in the middle of this run, thus distributing the load evenly over the two vertical legs of the ring. This arrangement works very satisfactorily.

WINDERS AND ROPE STRESSES

Various electrical control systems compared

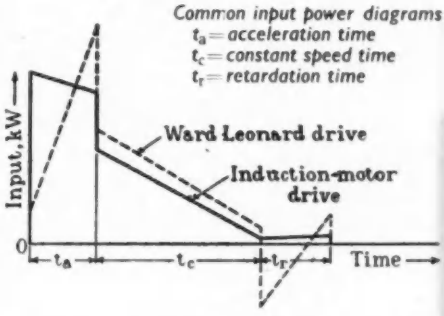
MUCH interest from the safety and operating economy aspects attaches to the behaviour of mine winders during the periods of acceleration and deceleration at the beginning and end of winds. In a paper read before the Utilisation Section of the Institution of Electrical Engineers on Thursday last, MR. T. A. PETCH, M.A., A.M.I.E.E. (B.T.H.), considered the effect of the electrical control gear on such terminal characteristics. His paper was entitled "Transients in Electric Mine Winders, and Their Effect on Rope Stresses."

Two general classes of electric winder are considered: that having an induction motor drive with rotor resistance control, and the other, where Ward-Leonard sets are involved. The diagram shows, for both types, the conventional input power/time diagrams derived from a speed/time diagram which assumes constant acceleration during t_a and constant retardation during t_r, with a steady speed maintained throughout t_c.

Starting Characteristics

Mathematical analysis of the problem of starting an a.c. winder shows that for constant acceleration the rotor resistance should be reduced in direct proportion to time. Consideration of change of rope weight as winding proceeds modifies this relationship, but it still holds as an approximation. With grid-resistors, starting necessarily proceeds in a series of steps, with the speed curve closely following the intended straight-line characteristic, but considerable peaks of torque at transitions from one resistor to another. Liquid controllers provide effectively an infinite number of steps, and the notching peaks disappear. However, it is only possible to get the ideal constant accelerating torque if the resistance, at the instant of starting, bears the required relationship to frequency and inductance and to the mechanical moment of inertia. If the torque is too low at starting, very high useless currents occur at the end of the acceleration period. Correction for this fault takes the form of strengthening the starter resistance electrolyte.

In a simple Ward-Leonard drive, the driver's lever controls a potentiometer in the generator field circuit. In the consideration of acceleration, three methods of operation are considered. First comes that in which the lever is put hard over to full speed. Initially the winder speed is above the straight-line speed, and the torque is considerably above the intended torque. Full-power input is reached fairly quickly, and then stays constant, the "conventionally expected" peak power not being approached. If the lever is moved steadily to its full speed position, the intended speed



curve is matched fairly closely, though the torque rises until the end of lever movement and then falls off while the drive continues to accelerate. Power input also rises during lever movement, and falls off afterwards, though less markedly than the torque.

An intermediate operation, with swift movement of the lever some part of the way across, and gradual change thereafter, causes the conventional speed and torque curves to be closely approached for most of the acceleration period. Towards the end, the torque and input power drop below the conventional values. The amount of initial movement of the controls is that needed to bring the torque to the value mentioned in the rotor resistance case.

Rope Stresses

In the final parts of his paper, Mr. Petch compares the likely relative rope stresses resulting from different types of induction motor and Ward-Leonard drives on otherwise similar winders. It is concluded, after much mathematical analysis, that there should, in fact, be no difference in the effects on the rope, and of the life thereof, if the means of driving the winder is either induction motor with liquid rotor-resistance control or Ward-Leonard. When metallic rotor resistances with finite steps are used, it seems that rope stresses are greater, but this depends on the magnitude of initial accelerations.

DISCUSSION

MR. B. L. METCALF (N.C.B.) considered paper in some detail, and asked why manufacturers always seemed to offer enquirers the theoretical diagram of power/time curves instead of true diagrams. Referring to liquid starters, he suggested that the ideal starting conditions mentioned in the paper were rarely achieved by drivers. Another weakness of the paper came from the assumption that the rope was stretched in zero time. This was not possible in practical conditions. More attention might have been given, he thought to deceleration and braking, in connection with which there were three conflicting requirements—quick, stop, minimum rope tension, and minimum discomfort for men in the cage. In conclusion he suggested that so far as the operating side was concerned, the answer to longer rope life and better control seemed to be automatic winding.

MR. H. DOLAN (English Electric) thought that graded acceleration was far more common than the author suggested. He went on to consider some problems of the retardation period. Agreeing with the author that the simple Ward-Leonard system was out-dated, he suggested that with other forms there was more chance of obtaining automatic control.

MR. H. HITCHEN (British Ropes) based his comments on a series of tests which he had made, using a decelerometer in the cage and a microtensiometer on the rope at the head gear. Amongst the points he illustrated were, that vibratory stresses set up by matching at the cage were not transmitted to the pulleys at the headgear, and that live loads were less with electrical winding gear.

MR. D. R. LOVE (Metropolitan-Vickers) welcomed the study of rope stresses from the starting aspect. He suggested that Mr. Hitchen's practical results showed that a.c. winders behave in the manner demonstrated by Mr. Petch's analysis. He showed an oscillogram which was one of a series taken on a.c. winders, with the object of proving to electrical supply authorities that very heavy current surges did not occur.

The AUTHOR replied to the discussion at some length, and suggested that the value of the paper lay in showing that rope stresses need not be a determining factor in the design of electrical mine winders, and that graded acceleration and large flywheels were not necessary to keep down current peaks.

THE PLACE OF THE WHOLESALER

E.W.F. Annual Dinner

AT the Savoy last week there was a distinguished gathering for the Annual Dinner of the Electrical Wholesalers Federation. The principal guest was the RT. HON. THE EARL OF VERULAM who had arrived in this country only the previous night. He proposed the toast of "The Federation," pointing out that wholesalers have to stock the right goods at the right prices and know their customers' requirements. They do better than any rationalised or nationalised authority; that is their reason for existence and prosperity. He spoke of his experiences on his recent African tour, mentioning that in Bulawayo where the load is doubling itself every three and a half years he was told that if only there were a few wholesalers with stocks, everything would be easy. At Angola where a large power station is being equipped by the Westinghouse Company and another large job has been completed by a British firm, he received the compliment from an American that "you guys in Britain will always beat us in giving the customer what he wants."

Replying to the toast, the President Mr. J. M. HOLLANDER, said that whatever changes may take place in the future, the wholesaler would be ready to adapt himself to the new conditions. By long standing co-operation with other sections the wholesaler has proved to be indispensable to the electrical industry. He hoped, however, that in times of shortages manufacturers would consider their interests are better served by distribution through the wholesaler. The supply of raw materials is causing acute anxiety; its full effect is not yet apparent, but it is going to be increasingly difficult to supply equipment to contractors. In a time of shortage the wholesaler by giving efficient service can indirectly save many hours of productive time being wasted. Finally, the President paid tribute to those who had helped to build up the Federation, pointing out that the standard required of members is a high one and their duty both to manufacturers and customers is stressed above all else.

In his inimitable style, Mr. A. GLENISTER proposed the toast of "Our Guests." Mr. T. W. HEATHER, replying for the manufacturers, gave a most amusing account of the views on wholesalers expressed by various members of the community. Also associated in the response was Mr. P. G. WALLIS, President of the Electrical Contractors Association, who spoke of the friendship owed by contractors to wholesalers. He spoke, however, of the too easy granting of trade terms to those who present a card to wholesalers, and he asked the Federation to adopt a fair trading policy for the protection of genuine electrical contractors.

Problems and Practice

IN ENGINEERING

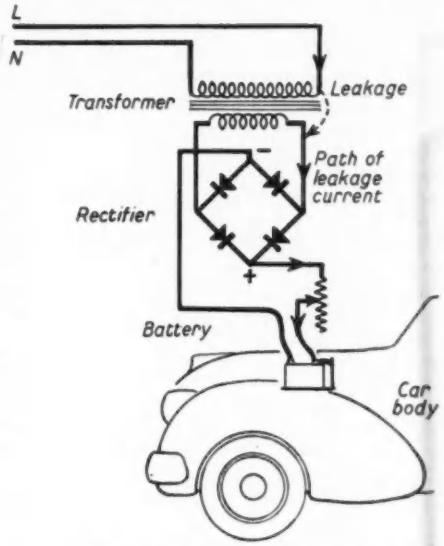
Flickering Lights

A COMPLAINT was received from a local school that some of the lights in the classrooms were very dim whilst in others they were brighter than normal, and all lights were subject to a considerable amount of flickering. An investigation showed this to be correct whilst, in addition, in the kitchen the potato peeler could only be used when the wash boiler was switched on. An open-circuited neutral was immediately suspected, the lights being connected in series between two lines, the number of lights switched on at any time in one circuit determining the impedance and consequently the voltage across the circuit. As other lights in the circuit were switched on the impedance would alter, this accounting for the flickering complained of. With regard to potato peeler, this was on a phase which had at that particular time a considerable amount of apparatus connected, giving a low impedance and consequently a low voltage across it. As a result this piece of apparatus would not operate until the wash boiler, which was connected to a plug fed from another phase, was switched on to reduce the impedance of that phase and raise the voltage on the other.

Having deduced the cause, efforts were turned to finding the position of the open circuit and this was soon discovered to be at the point of supply intake. Here two double pole cut-outs had been utilised in place of the conventional triple pole and neutral, and the neutral fuse had blown. This fuse was replaced by a solid bar, produced from the metalwork class and the cut-out changed for a t.p.n. as soon as this was available.—*J. P.*

Shock through Leakage

IT is not always appreciated that quite an unpleasant electric shock may be experienced from a piece of electrical apparatus which is not earthed, even when the insulation of the apparatus is quite good. No insulation is perfect, of course. Thus it follows that there is always some leakage of current between points which are subject to a difference of potential, although this leakage current may be much less than 1/10,000th of the rated current of the circuit, if the insulation is in good condition. If the framework of the apparatus is earthed the leakage current will flow harmlessly to earth, and the framework will thus be maintained at earth potential. If the framework is not earthed and the current



Build-up of voltage on coachwork

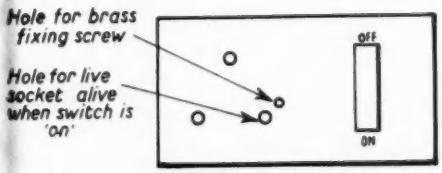
leaking in a constant direction will eventually charge the framework with electricity, unless the current can leak from the framework to earth through some fortuitous path such as a damp wall or structural steelwork.

Unsatisfactory conditions may arise if the framework is well insulated from earth. These conditions occurred in a trickle charger mounted on a dry wooden bench and used to top up the charge in a car battery overnight. The case of the charger was evidently well insulated from earth, as was also the electrical circuit; whilst one pole of the battery was connected to the frame of the car in the usual way. Slight leakage between the primary and secondary windings of the transformer, as indicated in the sketch, over a period of 16 hours, charged the framework of the car to a high value. Actually the voltage which would be attained by the car would be equal to $\frac{Q}{C}$ where C is the capacity of the car body in farads, and Q the charge

in coulombs (equal to the product of leakage current (amps) and time in seconds). Eventually the voltage of the car would rise practically to the *peak* voltage of the a.c. supply. A severe momentary shock was received by the driver when touching the car in the morning, as he discharged the car to earth by connecting his body across the tyres. Such a shock might be dangerous if received unexpectedly by a person in a precarious position. The moral is always to connect one point of the secondary circuit, and the case of the charger, to earth.—*J. L. W.*

Live Fixing

ONE of my neighbours complained to me the other day that his wife had received a shock from a switch socket and would I like to have a look at it. On asking his wife how exactly she had come to get the shock, she told me that she'd noticed that the switch was in the "on" position with no plug in the socket and on switching it to "off" she felt the shock. The switch socket was a 2-amp 3-pin type which she used for her electric iron, and sure enough the brass screw which held the top in position was alive when the switch was "on." The trouble proved to be a short strand of wire which had in some way bridged the gap between the brass cap-fixing screw and the live socket, but a queer point was that if a plug was in the



Details of switch cover

socket it covered the brass screw and so a shock could only be had when there was no plug in and the switch was "on." The distance between the live socket and the brass screw was only $\frac{1}{8}$ in.—*J. H. H.*

Guard Prevents Maintenance

I WAS called to a machine shop with an overhead shafting, belt driven from a 15 h.p. 3-phase motor with a web frame and sleeve bearings. The motor and main belt were enclosed in a large angle iron and mesh guard cemented into the floor and carried into the concrete ceiling. I was informed that there was difficulty in starting, the motor humming loudly, and the start-delta starter could not be moved to run position.

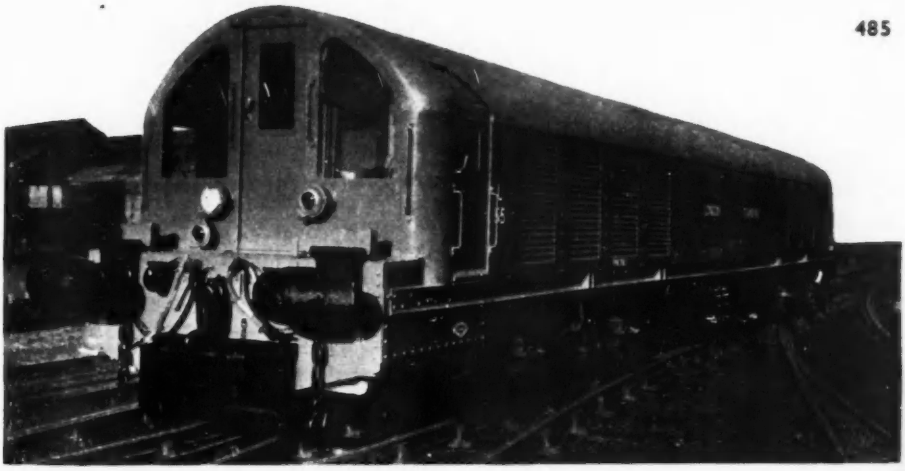
After examining the starter and wiring and checking mains voltage and finding all in order, I started on the motor. This meant removing the guard bodily and took some time to chip out. Eventually I was able to check, and found the rotor was seized up. On removing the end-plate the rotor was forced out and the cause of the trouble was easily seen; there was a band of grease and dirt about 1 in. wide and 15 thou. thick round the rotor. This hardened overnight and formed a brake between rotor and stator. This warmed up after repeated attempts to start and eventually freed itself. This trouble, which could have easily been avoided by a regular clean, shut the shop for a day. A little more thought to the design of these guards would enable the maintenance staff to do their work without having to leave well alone as in this case.—*H. G. Bryant.*

Loose Copper Strap Causes Trouble

WE were recently called to investigate reported trouble on a 90 h.p. haulage motor circuit in a coal-mine. The motor was of the 3-phase, 400 V slip-ring type, controlled by separate rotor and stator switches, these stator switches taking the form of an oil circuit-breaker. On closing this o.c.b., another c.b. controlling the circuit in the mine's power station tripped; on re-closing the stator switch and then the motor stator switch the power station c.b. tripped as before. Measurements of the ins lation resistance of the motor windings and the supply and motor cables gave satisfactory values. As the tests on the cables to the stator had included the stator switch, we were about to dismantle the motor to examine the windings when it was realised that the stator switch was not closed during the insulation tests, and they did not therefore include the moving portion of the switch.

We lowered the oil tank to gain access to the moving contacts of the stator switch, and at once found the fault. The wedge-shaped moving contacts on each phase bar were connected by a flexible copper strap; one of the straps had become detached and was suspended from the other end. With the oil tank in position, the loose strap had been in contact with it, and when the switch was closed had immediately short-circuited one phase to earth.—*B. T. R.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.



LONDON TRANSPORT accepts delivery of new Battery Locos

Ease of Battery handling a feature of design

IN order to facilitate maintenance, cable-laying and construction work, the London Transport Executive is accepting delivery of seven new battery locomotives. Electrical equipment on these locomotives has been manufactured by G.E.C. with the exception of the batteries which have been supplied by the D. P. Battery Co., Ltd., Bakewell, Derbyshire. R. Y. Pickering and Co., Ltd., Wishaw, Scotland, were responsible for the mechanical parts.

Performance

For track-laying operations, two locomotives in multiple-unit must handle a 200-ton construction train at 30 m.p.h. on the level when running on the 600 V system, or at 15 m.p.h. when supplied from the batteries. On the construction site they must be capable of inching the train forward on rough track up gradients as steep as 1 in 30. For cable-laying work, a single locomotive must handle a 100-ton train and be capable of being driven continuously at speeds as low as 3 m.p.h.

These characteristics have been obtained by using three combinations of the four motors (all in series; two series pairs in parallel, and all in parallel) in conjunction with multi-notch resistance stepping and suitable resistance ratings. All three combinations are obtained on the one controller handle which provides a total of 28 notches.

A hand-operated switch enables the driver to put the battery on charge from the live rail under fully automatic control, the rate varying according to the condition of the battery, and charging being stopped when the battery is fully charged. Means are provided for giving the battery a gassing charge under skilled attention at the sheds, but this procedure is necessary only at considerable intervals.

In these latest locomotives, it has been possible to provide a battery of 1,008 amp-hr capacity, as compared with the pre-war figure of 768, thus giving a higher availability factor. Modifications have also been made to the main motors—which are of the standard L.T.E. design as supplied by G.E.C. for other duties on the Executive's railways—to give them characteristics similar to those of the motors in the earlier locomotives. It is therefore possible to operate the pre- and post-war locomotives in multiple if required. As modified, the motors are rated at 210 h.p. (1 hr) and 150 h.p. (continuous).

Changing Batteries

The original method of changing batteries was by lifting them through the roof by crane. This was found somewhat inconvenient and in these latest locomotives runners are permanently built into the body to carry a small lifting device which can be so positioned as to reach any cell, raise it, and after transporting it, lower it through a trapdoor in the floor.

The locomotives and the equipment have been designed under the direction of Mr. W. S. Graff-Baker, Chief Mechanical Engineer (Railways) London Transport.

overseas news

Utilities Board Proposed

In Bridgetown, B.W.I., the Barbados House of Assembly has recently given consideration to a Bill to set up a Public Utilities Board, and has approved many of its sections. The public utilities which the Bill seeks to control are electricity, gas and telephones. The Board will consist of three members appointed by the Governor and its principal function will be to supervise public utilities exercising monopolistic powers, so as to ensure that the rates which they charge are fair and reasonable and the service which they provide is adequate.

Howard Station Nearly Ready

The Howard power station was making good progress, and should materials be delivered as promised, the station could possibly be put into service in five or six months' time, Mr. J. R. Cooper, manager, informed the Wide Bay Electricity Board, Queensland, at its meeting a few days ago. Transmission and distribution lines in the rural areas were well under way.

H.P. in Australia

The developed power available in Australia today was only about 0·34 h.p. per person, compared with 1·34 h.p. per person in Canada, the Commonwealth Minister for National Development, Mr. R. G. Casey, stated earlier this month. It was estimated that in the next 10 years the demand for developed power in New South Wales would increase from 1,099,000 h.p. to nearly two million, and in Victoria from 675,000 to 1,072,000. Mr. Casey was commenting on a report which the Snowy River Committee just issued which emphasises that as progress was made with the Snowy Mountains hydro-electric project, there must be a corresponding expansion of steam generating power in New South Wales and Victoria.

Competition

That the Snowy River hydro-electric scheme should be temporarily scaled down because it was taking much needed men and materials that could be used on Victoria's power projects, was the view expressed by Mr. R. A. Hunt, chairman of the State Electricity Commission of Victoria, recently. He considers that the Snowy River scheme cannot produce useful electricity for Victoria before the Commission completes its own projects and improves present production facilities. He felt it would be much better for Victoria to be allowed to go ahead with its own schemes and complete them in five or six years without having to compete with other authorities for men, money and plant. Scaling down the Snowy scheme would not necessarily mean that Victoria's projects would be speeded up. Rather, it would prevent Victoria's projects from being slowed down, because men and materials would be available on time for construction timetables, he emphasised.

B.C. Development

The Whatshan hydro-electric development of the British Columbia Power Commission is expected to commence operating at the end of next month. The plant, designed to meet the power needs of the North Okanagan, will have an initial output of 33,000 h.p., which ultimately will be doubled. The 13,000 prospective consumers for the plant are now served by two small hydro units at Shuswap and Barriere and a steam plant at Kamloops, which have a combined capacity of 14,000 h.p. Whatshan Lake provides a 710-ft head of water fed to turbines on the shore of Lower Arrow Lake via two and a half miles of tunnel through solid rock. The development, including 140 miles of transmission lines, is estimated to cost $6,700,000.

Largest H.E. Development

The Beauharnois power project is expected to be the largest hydro-electric development on the continent when the third and final stage in its construction is completed, C. G. Kingsmill, assistant chief engineer of the Generating Stations and Hydraulics Division of Hydro-Quebec, said in a lecture to the Engineering Institute of Canada a few days ago. The project will develop 1,800,000 h.p., the present largest in Northern America being the Grand Coulee, Washington, development with 1,760,000 h.p. Designed to be built in three stages, the Beauharnois project utilises the drop in the St. Lawrence River between Lake St. Francis and Lake St. Louis. The first stage was completed in 1932, and the main work on the second was completed last November. Work on the third and final stage has yet to be done.

Manitoba's Progress

The rapid growth of Manitoba's industry outside the greater Winnipeg area is reflected in the thirty-first annual report of the Manitoba Power Commission, covering the twelve months to March 31, 1950, just published. During that period, industrial power consumption in rural Manitoba increased by 19·4%. Altogether 11,629 new consumers were added, of which 4,791 were farms. Total power sales were 36·1% above the previous year's figure, the system's peak demand increasing by 36·7%.

Winnipeg Plea

Given the opportunity and reasonable security of tenure, the Winnipeg Electric Company would gladly take care of Manitoba's power requirements, W. H. Carter, the company's president, declared, when addressing delegates to the three-day convention of the Western Section of the Canadian Electrical Association, recently. No matter what happened in the future, he stated, the company was proud of past achievements. It had brought the first hydro-electric power into Winnipeg in 1906 and had developed additional sites to keep production capacity ahead of demand. With little prospect of further water power developments, the possibilities of steam plant were now being considered.

Cable Production?

It is reported from New Delhi that the Indian Government has concluded an agreement with a leading British firm of cable manufacturers for the setting up of a cable manufacturing unit in India immediately. A site adjacent to the government locomotive factory at Chittaranjan is now being surveyed and levelled and a five million rupee allotment for preliminary construction has been made in this year's budget. The name of the British company concerned has not yet been disclosed.

Waiheke Island Scheme

The Auckland Electric Power Board, N.Z., is to seek the inclusion of Waiheke Island in its area preparatory to erecting distribution lines in the area. Mr. C. J. Lovegrove, the chairman of the Board, has said that the Board had reached the stage where it could define broadly its attitude in the matter. A resolution to apply formally to the Minister in charge of the State Hydro-Electric Department, for the Board's jurisdiction over the island was carried. The Board hoped to have the work done by contract. Negotiations with an English firm had been going on for some time. Labour was not expected to be a great problem, but orders for materials, particularly the submarine cable, should be placed immediately. A special loan for the work would be needed. The Board expected 6,000 consumers.

Steam Plant Wanted

The New Zealand Electric Power Boards and Supply Authorities Association is to urge on the Government the need for steam plant to augment the inadequate capacity of State hydro-electric stations. Mr. C. J. Lovegrove, president of the Association, referring to the Maraetai, Whakamaru, and South Island schemes, said these new hydro-electric stations would do little more than meet the back-log of demand for power.

Waipori Development

The Waipori hydro-electric extension scheme in the South Island, New Zealand, by which Dunedin's generating capacity will be increased from 28,000 to 42,000 kW, is rapidly taking shape. The two tunnels Nos. 3 and 4 have been pierced, but are yet to be concrete lined, and the excavations for the foundations of the two dams, the construction of surge tanks, and the installation of head gates has begun.

The plans for the two power stations are in preparation for the calling of tenders, and the generating equipment they will house is now being made in England. The City Corporation's electricity department, which will install the plant, has begun the initial work entailed in linking the two stations with the existing supply lines. The speed at which the project is progressing should ensure the new services being in operation early in 1953, 46 years after the Waipori River was first harnessed to provide electrical energy. No. 3 station, which will be completed first, is to have a capacity of 6,400 kW and No. 4 will generate 7,200 kW. Some time ago a fifth power station was mooted for Waipori, but an investigation showed that at today's costs the building and maintaining of the extra station would not be warranted by the small amount of power that it could generate.

Take-over

March 31 has been fixed by the Marlborough Power Board, N.Z., as the date that the Board will assume control of Picton borough council power supply undertaking. The manager-engineer, Mr. G. F. MacLean, reported that most of the ordinary consumers would have changed over from direct current by that date.

Rhodesia's Project

The foundations of the Electricity Supply Commission of Southern Rhodesia's power station at Shabani are now being laid next to the present station. The project is expected to be completed by the middle of 1952. It will comprise two 5,000 kW generators, with two boilers, and will cost £1,000,000. It was planned originally to supersede the existing plant, which is of 11,250 kW capacity, but at first the new plant will apparently operate in addition. Three routes for 88,000 V distribution lines from Shabani have recently been surveyed, one to Belingwe, one to Mashaba and Fort Victoria and a third to Gwelo.

New Plan for Japan

A plan for the decentralisation of Japan's electric power industry has been published by the Public Utilities Commission. It is suggested that the new arrangement should operate from May 1. A meeting was held last month between representatives of the Commission of the Japan Generating and Transmission Co. and its nine distributing companies which were established by the Government during the war. These undertakings control about 75% of Japan's electric power.

Geothermic Power

Natural steam jets will operate Japan's latest power plant in a station being built at Beppu, Kyushu, the southernmost island, according to reports. Work started on the site last July.

PERSONALITIES

IN THE INDUSTRY

Newly appointed chief of development and engineering to E. K. Cole Ltd. is **Mr. H. Hunt,** M.Brit.I.R.E., who has been with that concern since 1931. In his new position he will be responsible to **Mr. A. W. Martin,** M.B.E., the chief engineer. In recent years Mr. Hunt has been engaged on the development of Ekco's post-war range of radio receivers and car radio for home and overseas, and, in particular, on v.h.f. airborne and ground communications and d.f. equipment. Prior to 1931, he served with the H.M.V. company, and for three years in the technical and research laboratories of A. Reyrolle and Co. Ltd., with whom he completed an articled training.

Mr. H. Hunt

To succeed **Mr. H. L. Bazalgette,** who recently retired, the English Electric Co. Ltd. has appointed **Mr. E. G. Teasdale,** B.A.(cantab.), as chief of their Hydraulic Section. Mr. Teasdale joined the company 28 years ago as an apprentice. Since 1931 he has been associated with automatic rotary convertor contracts, synchronous condenser contracts and hydro-electric work. He was a member of the technical mission which visited India between December 1944 and May 1945.

Following the release of **Mr. A. G. E. Briggs,** an assistant managing director of Simplex Electric Ltd., to serve as Deputy Controller of Supplies (Munitions) Production, Ministry of Supply, his responsibilities as managing director of Simplex have been taken over by **Mr. E. G. Plucknett,** commercial director, and **Mr. A. G. Jones,** works director, who have now been appointed joint managers.

Formerly district commercial engineer at Chesterfield No. 1 Sub-area of the East Midlands Electricity Board, **Mr. E. A. Thomas,** A.M.I.E.E., Mem.A.I.E.E., A.M.I.I.A., F.R.S.A., has been appointed senior assistant engineer in the Commercial Section of No. 3 Sub-area headquarters (Chester) of the Merseyside and North Wales Electricity Board.

Alderman B. J. Watson, A.M.I.E.E., has been nominated as Mayor-elect of Maidstone. He has been a member of the Council since 1936. He recently retired from the position of district electrical surveyor to an engineering insurance company, and is now associated with a local firm of electrical engineers.

Previously of the English Electric Co.'s Export Department, London, **Mr. L. St. John McDermott,** has taken up the post of technical representative with the company's agents at Rio de Janeiro.

Mr. T. D. Turner, Assoc.I.I.A., of Twickenham, has been appointed works manager of Igranic Electric Co. Ltd. He was for five years general works manager with Spooner Equipment Ltd., and afterwards for four years with a London consultant.

The Minister of Fuel and Power has reappointed the following part-time members of Area Electricity Boards:

Southern : Rt. Hon. Arthur Creech Jones and Lt.-Col. D. S. Kennedy, D.S.O., J.P., M.I.Mech.E., M.I.B.Ag.E.

Yorkshire : Mr. A. R. Baines, C.B.E., and Alderman R. Barber, J.P.

North Eastern : Sir Tristram Edwards.

Managing director of Nevelin Electric Co., Ltd., **Mr. A. Newing,** A.M.I.E.E., has been appointed to the board of directors of Lancashire Dynamo Holdings Ltd., formerly Lancashire Dynamo and Crypto Ltd. He is also a director of British Electronic Products Ltd., another company in the L.D.C. group. Mr. Newing has been primarily responsible for Nevelin's expansion since its inception in 1936.

Mr. A. Newing

Appointed sales manager of the newly-formed Denis Ferranti Co., Ltd. of Oldham, Lancs, is **Mr. Michael Schofield,** who recently resigned his position as deputy export sales manager of Ferranti Ltd., of Hollinwood, Lancs, which he had held for the past year. Previously he was Ferranti Ltd.'s Middle East representative, with headquarters in Cairo, from 1946 onwards. Our older readers with good memories will well remember the late Mr. R. H. Schofield who was for many years general sales manager of Ferranti Ltd., and a director until his death in 1935—Mr. Michael Schofield is his son.

Mr. M. Schofield

With 43 years' service in the electricity supply industry, **Mr. A. J. Lovell,** A.M.I.E.E., mains construction and planning engineer, No. 1 sub-area, North Western Electricity Board, has retired. To mark the occasion he was presented with a portable typewriter and desk fan, subscribed by his colleagues, by **Mr. H. G. Bell,** sub-area manager, at a large gathering of present and former colleagues. Mr. Lovell's varied career was spent with the former Manchester Corporation Electricity Department, and its successors the North Western Electricity Board, following training with the Cheltenham and Newcastle-on-Tyne undertakings. Going to Manchester in 1907 as an assistant to Mr. L. R. Lee, he finally became mains engineer. This period covered one of remarkable growth, and Mr. Lovell was largely responsible for the laying of a modern cable system which in turn superseded the old 5 wire, V.B. solid and copper strip d.c. system.

Ekco-Ensign Electric Ltd. announce the appointment of **Mr. S. Bugden** of 7 Broadmead, Biggleswade, as their representative for the counties of Bedfordshire, Huntingdonshire, Cambridgeshire, Isle of Ely and part of Hertfordshire. He will be attached to the company's southern sales office at 5 Vigo Street, London W.1.

Mr. S. Bugden

Sheffield University is to confer a D.Eng. honorary degree upon **Dr. Percy Dunsheath,** C.B.E., M.A., D.SC., M.INST.C.E., M.I.E.E., at a special congregation on July 12. He is at present in America with a team which is studying the relations between universities and industry there.

Several appointments are announced by Smart and Brown (Engineers) Ltd. (whose ordinary share capital was recently acquired by Thorn Electrical Industries Ltd.). **Mr. S. V. Spear** is now export manager; **Mr. A. A. Owen** has been nominated home sales manager at the Manchester office (he has been northern area manager since 1947), and **Mr. P. A. Tutton** has been appointed representative in the London area. Mr. Tutton commenced his career with the B.T.H.Co. at Willesden; since 1946 he has handled the sale of Prestcold commercial refrigeration equipment in Sussex.

Mr. S. V. Spear

We learn that **Mr. B. Jubb,** B.SC. (ENG.), A.M.I. MECH.E., A.M.I.E.E., WHIT. SCH., has been appointed sales manager of the Instrument and Meter Section of CromptonParkinson Ltd. Except for war service and a few years spent with Asea Electric Ltd. in England and India, Mr. Jubb has been with Crompton Parkinson Ltd. since 1931.

Mr. B. Jubb

The resignation by **Mr. A. J. Fippard** of his chairmanship of the Kalgoorlie Electric Power and Lighting Corpn. Ltd., owing to increasing deafness, has been accepted with regret. He remains a director, but **Mr. W. F. Talbot** has been appointed chairman in his stead.

OBITUARY

We note the death, on March 8, of **Sir John Darwood,** aged 77, who founded and managed from its inception in 1905, the Rangoon Electric Tramway and Supply Co., Ltd.

Formerly local engineer and manager of the old Ramsgate and District Electric Supply Co., Ltd., **Mr. E. Lewis,** A.M.I.E.E., has died, aged 68. He retired three years ago after 20 years' service with the Ramsgate undertaking. Previously he had been with undertakings in London and Surrey.

Formerly deputy chairman and joint managing director of Southern Areas Electric Corporation, Ltd., **Viscount Elibank** died on March 11, aged 74.

We learn of the death on March 15, at Killearn Hospital, Stirlingshire, of **Capt. J. Griffith-Jones,** A.M.I.MECH.E., A.M.I.E.E., A.M.I.E.I., aged 68, who served for some time with the Ministry of Supply, at Sale, Manchester. He also acted for a while as engineers' agent. Earlier he went to America, serving at the Electra power station, California, and with an electrical manufacturer at Los Angeles. He returned to this country as assistant to the works manager of the General Electric Co., at Birmingham. After service in the 1914-18 war, he devoted his attention for a while to the design and manufacture of superheaters for locomotives and marine work.

The death occurred recently of **Mr. E. A. B. Chrich,** at his home in Beeston, Notts. He was senior section head (operation and maintenance) in the Chief Engineer's Department at the headquarters of the East Midlands Electricity Board.

WILLS—Mr. G. Grainger, M.I.E.E., M.B.I.F., F.R.S.A., chief works engineer of J. A. Crabtree and Co., Ltd., left £2,761 (£2,349 net value).

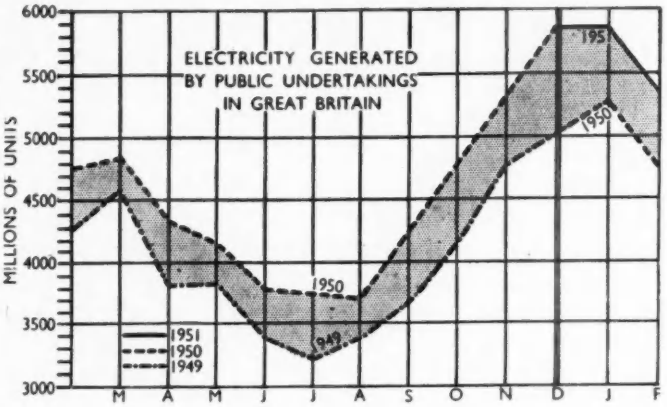
Mr. F. G. Ticehurst, A.M.I.E.E., for many years a member of the staff of the British Electrical and Allied Manufacturers Association, and its second-in-command in the Transformer Dept., left £6,609 (£5,729 net value).

UNITS GENERATED

5,340 million units was the total generated during February, 1951, in stations under the control of the B.E.A., the North of Scotland H.E. Board, and the Lochaber Power Co. The corresponding figure last year was 4,720 million, so there has been an increase of 13·1 per cent.

Of the total, 5,189 million units were generated in steam stations and 150 million in hydro-electric.

Energy sent out during the month was 5,051 million units, 94·6% of that generated. This gives the total for 1951 so far, as 10,679 million units, an increase of 13·1% on the corresponding period of 1950.

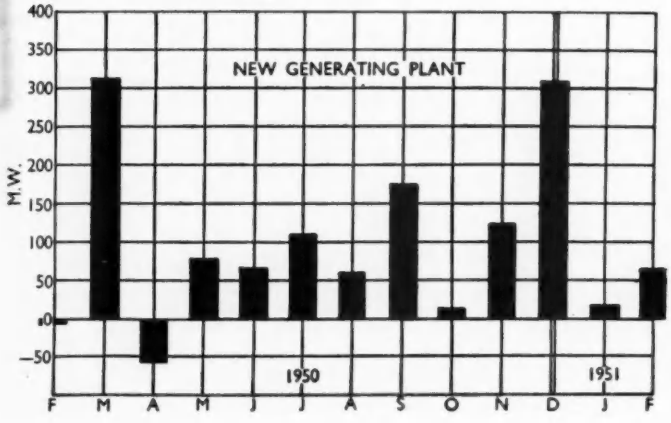


POWER SUPPLY IN FEBRUARY

ONLY one station increased its installed capacity during February, and this was Portobello, in the S.E. Scotland Division. There the first of two Richardson-Westgarth 60 MW sets was commissioned, and in interest it makes up for the lack of any other turbo-alternators to list this month. A description of the set while it was being manufactured was given in the ELECTRICAL TIMES of May 26, 1949 (p. 705). It is a cross-compounded machine driving two 30 MW alternators, and has been designed for steam conditions of 1,350 lb/sq in. at 950° F, and for a vacuum of 29·1 in. mercury. The high pressure section is a two-cylinder machine, while the low pressure turbine has two sections of intermediate l.p. blading and four of l.p. blading, a quadruple exhaust discharging into a single shell condenser. The two alternators are permanently connected together for electrical output, but each machine has its own exciter.

Generation

Figures now available for generation in the United Kingdom show that the simultaneous maximum load recorded during 1950 was 11,915 MW, in December. This is 617 MW greater than the previous maximum, which occurred in January, 1950. The average installed capacity of plant during December was 14,930 MW, and the peak load was 80% of this total. In January, 1950, the plant installed was 13,913 MW, and the peak load 11,298, giving a ratio of 81%. At both times available capacity was, of course, less.



GENERATING PLANT

At the end of February 1951, the installed capacity of the B.E.A. was 14,634 MW, showing an increase of 63 MW during the month. In the same period, the North of Scotland total increased by 1 MW to become 529 MW. The figure for overall increase in the last 12 months is 1,263 MW, or 9·1%.

The total installed capacity for the purpose of this graph should be distinguished from the output capacity. The installed capacity is the total m.c.r. of all the generating sets which are connected on both steam and electric sides and are suitable for service.

Progress in Production

Heavy Export Commitments in all Classes of Equipment Evidenced in this Review of Activity during 1950

No. 8, Crompton Parkinson Ltd.

ALTHOUGH direct exports from the factories of Crompton Parkinson average about 20% of the total production, the indirect exports are estimated to be as high as 30%. These facts were pointed out at the last stockholders' meeting by the Chairman of the company, Mr. Albert Parkinson, M.B.E.

In support of this statement, the Company has been concerned with the planning and in some cases the supply of equipment for several large overseas contracts. For example, the alternators, switchgear and cables were supplied for the Ceylon Government's cement plant, and ancillary equipment included lighting and distribution plant.

Other contracts dealt with either directly or through overseas agents included extensions to the power house and system at Kuwait; the Torroro Cement Works, Uganda, power supply; and work for the Uganda Electricity Board. In India, contracts were carried out for the installation of equipment at the Travancore Rayon Co.'s mills, the Madura Cotton Mills and the Birla Jute Mills at Calcutta.

Electrical Machines

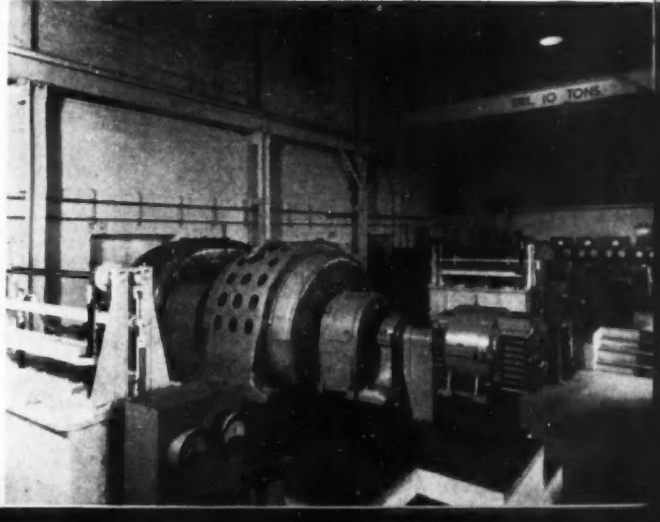
The output of a.c. and d.c. machines was maintained at its maximum throughout the year. Of interest is a new range of totally enclosed motors designed to be interchangeable with types conforming to American and Canadian standard. An unusual feature of this range is that for each frame size there are two distinct designs of windings and rotor, so that although the frames are identical there are alternative ratings for either the American or the British market.

An addition to the range of machines now being made is the "Magnicon" self-regulating alternator now being manufactured at Chelmsford under an exclusive licence from Messrs. MacFarlane Engineering Co., of Glasgow. This alternator is inherently self-regulating within $\pm$ 2½% of normal voltage, and can be designed if required with regulation of $\pm$ 1%.

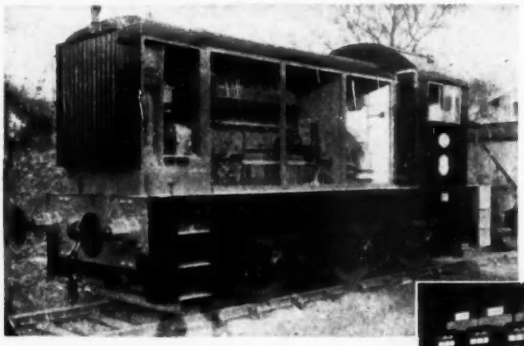
Switchgear

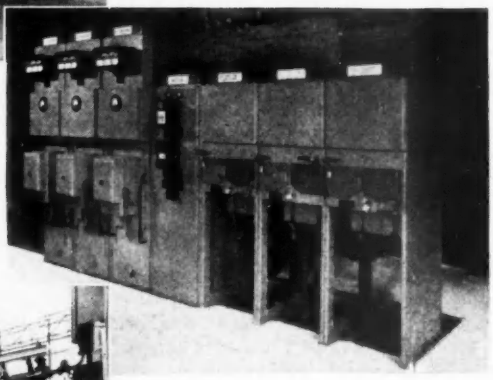
A further development of the type "ALA" switchgear is the type "CLA" for ratings up to 11 kV, 600 amp, normal current, 250 MVA breaking capacity. Further additions to the normal range are the "ASA" fault capacity making isolator and the "ARA" ring main control unit. The former unit has a rating of 400 amp at 11 kV, 3-phase, and is capable of being closed in against fault capacities of 250 MVA at 6·6 kV, 3 phase, or on a system where the peak symmetrical short-circuit currents do not exceed 21·8 kA.

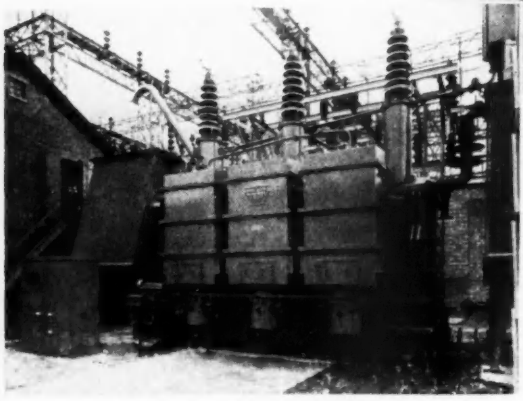
During the year, switchgear supplied included 11 kV and 400 V metalclad units for the North of Scotland Hydro-Electric Board; equipment for the Sheffield University extension; and an 11 kV, 250 MVA duplicate busbar metalclad installation with remote control switchboard for the B.E.A. Other plant was supplied to the British Sugar Corporation at Bury St. Edmunds and to the Steel Co. of Wales for their new rolling plants at Margam and Abbey.



Part of an installation of 1,000 h.p. auto-synchronous motors driving cement mixing kilns







Above: C.P. Paxman Diesel electric shunting locomotive for steel works service

Right: 11 kV switchgear type ALA o.c-b units and ASA oil immersed isolator units.

Below: A 60 MVA 132/33kV transformer with type LS on-load tapchange gear remote push-button operated

Traction and Transformers

Traction motors remained in heavy demand both for home and overseas service. For the Toronto Transport Commission, traction motors were designed and constructed to be mechanically and electrically interchangeable with the latest type of American motor fitted to their P.C.C. tramcars. This development provides a high performance motor suitable for installation, without modifications, in the many hundreds of standard tramcars with Clark truck and P.C.C. equipments operated overseas.

In this country motors and control equipments were supplied for the new trolley buses of the Nottingham and Rotherham Corporations, and traction motors for the new 8-ft wide trolley-buses at Bournemouth.

Transformers are manufactured at the works of the British Electric Transformer Co., Ltd. (in association with Crompton Parkinson) and output has been maintained at the limit of capacity. The B.E.A. has received nine 60 MVA, and a number of 45, 24 and 15 MVA, units. To the North Western Electricity Board went 26 units in sizes ranging from 200 to 750 kVA. The same Board also had two 20 MVA and one 15 MVA quadrature booster equipments. Other transformers were supplied to the Midlands Board. Many transformers were installed at the Rogerstone Works of the Northern Aluminium Co.

Other Items

Lighting accessories and equipment have continued in strong demand, and included in the industrial range is a new conception for a fluorescent fitting for use in dusty, wet or chemical-laden atmospheres, and particularly designed for conditions in Indian textile mills. Many installations have been designed and completed by the Lighting Engineering Section. Young batteries are being produced with resin-bonded glass silk envelopes to hold the paste firmly in the positive plate, giving longer life, lower internal resistance and greater discharge properties.

Considerable progress was also made in extending the range of application of the Nelson stud-welding equipment which has been used on the Festival of Britain site, the Pimlico District Heating Scheme and in the construction of ships and power stations.

The BUYER'S *Column*

New G.E.C. T.V. Receiver

JUST released by THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is a new console model television receiver fitted with a 12-in. aluminised cathode ray tube and a daylight filter. The receiver is available for London, Midland or Northern frequencies, for operation from 200-250 V d.c. or a.c. mains.

It is mounted in a veneered hardwood cabinet and gives a 10½ in. by 7½ in. black-and-white picture of exceptional brilliance. Definition and focus are extremely good, and efficient spot-limiting and noise suppressing circuits minimise the effect of man-made interference. Armour-plate glass is used to protect the c.r. tube, which is sealed to a moulded rubber mask to prevent the entry of dust. Sound is presented via a 10-in. moving coil loudspeaker.

The controls for normal operation of the set are "brightness" and "volume/on-off switch," and there are subsidiary controls for "hold" and "contrast."

To achieve maximum efficiency, miniature all-glass valves are used in superheterodyne circuits. The video response is level from zero to 3 mc/s, and stable hard-valve time-base and synchronising circuits guarantee a steady picture under all conditions. E.H.T. for the cathode ray tube is obtained by valve rectification of the line time-base flyback voltage, and the main h.t. supply is obtained from a generously rated selenium rectifier.

Price is £61 14s. 8d., plus £13 17s. 4d. purchase tax.

"Plastapack" Condenser Range Extended

THE original range of "Plastapack" plastic film condensers introduced by THE TELEGRAPH CONDENSER CO., LTD., North Acton, London W.3, has been extended to cover a much wider range in the lower capacitances. Further experience of this dielectric has enabled the company to re-rate the working voltage to 350 V d.c.

These condensers have been specially developed to meet the stringent conditions experienced in counting circuits and other allied computing devices requiring long time constants, medical X-ray dosage meters, the measurement of ionisation currents, etc. They have a high insulation resistance which is of the order of 250,000 meg-mfds at 20° C, whilst the power factor being 0·0002 is equal to that of the best quality mica.

With paper dielectric condensers, the insulation resistance diminishes rapidly as the temperature rises, so that certain applications are not met by this class of condenser. The I.R. of plastic film condensers as compared with that of paper dielectric condensers is well maintained at higher temperatures as will be readily seen by the following comparison:—

Plastic—I.R. at 60° C is 30% of I.R. at 20° C.
Paper—I.R. at 60° C is 4% of I.R. at 20° C.

An advantage of their inherent negative capacitance temperature coefficient is the effect of offsetting the usual positive temperature coefficient associated with coils and resistors in timing or tuned circuits. An added feature of this particular design of condenser is its low dielectric hysteresis and completely stable capacitance.

To date ten values have been developed from 0·01 mfds-4·0 mfds; they are wax filled, metal cases and the use of glass terminals ensures that the high I.R. of the unit is not impaired.

Standard range: 350 V d.c. working at 60° C. Capacitance tolerance ±20% and ±10%, closer limits will be available at slightly extra cost. Temperature coefficient of capacity -160×10^{-6} per °C.

Another Radio and T.V. Company

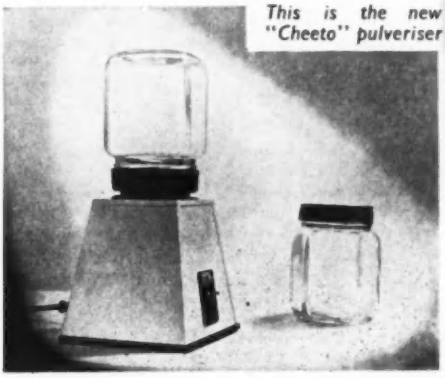
PLANNED to commence production in May are the first two television sets of the newly formed STELLA RADIO AND TELEVISION CO., LTD., of Oxford House, 9 Oxford Street, W.1. These will be a table model and a console with 12-in. screen. Distribution is to be exclusively through wholesalers.

The "Cheeto" Pulveriser

AS mentioned in our review of the Ideal Home Exhibition in the March 8 issue, JOHN PERRY AND CO. (PLASTICS), LTD., 105 Baker Street, London W.1, are displaying a new domestic aid, the "Cheeto" pulveriser.

Forming a "stable companion" to the well-known Cheeto "Handy Mains Mixer," this appliance forms a new departure in liquidisers. It combines low price with ease of operation and cleaning.

It is supplied with two jars, each with a separate plastic screw-on cap, which can be used for



This is the new "Cheeto" pulveriser

This stylish new convector heater by Bratt Colbran, Ltd., is available in ¾ kW and 1½ kW ratings. See Ideal Home Exhibition, March 8 issue

storage vessels as well as containers for use with the liquidiser.

Fitted with blades enclosed in a separate cap which can be unscrewed for ease of cleaning, the unit grinds coffee, shreds vegetables, makes purées, will chop mint and parsley, mix milk shakes and liquidises fruit, all in a few seconds.

Expected to be available on the home market after April, 1951, the model, which will carry a twelve-month guarantee, will cost £9 19s. complete.

The "Farmer" X-Ray Dosemeter

PROVIDING a simple instrument of high accuracy and reliability for the routine checking of X-ray tube output and dose distribution, the "Farmer" sub-standard X-ray dosemeter has been introduced by the BALDWIN INSTRUMENT CO., LTD., Dartford, Kent, at a low price.

It comprises a small thimble ionisation chamber and an electrometer valve null indicator interconnected by a long flexible cable. The instrument operates on the Townsend balance principle.

Fully portable, the instrument is battery operated. It is calibrated with a scale from 0-60 roentgens. The calibration is accurate, consistent and stable to 1%.

An outstanding advantage of the instrument is that repeat readings can be taken without entering the X-ray room, since the charging process can be started, terminated or cancelled by means of the switches provided; the instrument giving a continuous indication of an integrated dose as exposure proceeds.

TRADE PUBLICATIONS

SPACE HEATERS. An industrial space heater produced by the Expanded Metal Co., Ltd., Burwood House, Caxton Street, London S.W.1, is featured on a new leaflet.

REFRIGERATION. Recently published by Pressed Steel Co., Ltd., Cowley, Oxford, is a brochure No. Z43 dealing with Prestcold refrigeration for the meat trade.

COLD PRESSURE WELDING. The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, have produced a further edition of their brochure.

RAILWAY SIGNALLING. A special publication produced by Metropolitan-Vickers-G.R.S. Ltd., Trafford Park, Manchester 17, surveys the electric signalling installations with which the Mile End-Shenfield section of British Railways (E.R.) is equipped.

SAFETY LOCK WASHERS. The "Palnut" safety lock washers are described in Palnut Bulletin No. 2 issued by the Palnut Co., Ltd., 28 Elder Row, Brighton 1.

NICKEL ALLOYS. Various types of furnace equipment and the heat resisting uses of high nickel alloys are featured in "Wiggin Nickel Alloys" No. 328, issued by Henry Wiggin and Co., Ltd., Wiggin Street, Birmingham 16.

DOMESTIC REFRIGERATORS. Frigidaire Division of General Motors Ltd., The Hyde, Hendon, London N.W.9, have sent us specification sheets dealing with the range of household and commercial refrigerators.

LAMPS AND LIGHTING. Now available is the new lamp catalogue No. 1,000 issued by Siemens Electric Lamps and Supplies Ltd., 38 and 39 Upper Thames Street, London E.C.4.

RESEARCH EQUIPMENT. Details of the latest patterns of the Duddell magnetic oscilloscope, produced by the Cambridge Instrument Co., Ltd., 13 Grosvenor Place, London S.W.1, are given in List No. 118 A, newly issued.

FOOD CONVEYORS. Details of the range of "Aristocrat" heated food conveyors for hospitals, restaurants, etc., are contained in a leaflet from the manufacturers, The Metal Commodity Co., 25 Sutherland Avenue, Cuffley, Herts.

MEASURING INSTRUMENTS. Master Frequency Meters and electrostatic voltmeters are featured in two new leaflets issued by Everett, Edgcumbe and Co., Ltd., Colindale Works, London N.W.9.

CABLES FOR SOUND DISTRIBUTION. A revised leaflet has been issued by The Telegraph Construction and Maintenance Co., Ltd., 22 Old Broad Street, London E.C.2, dealing with Telcon cables broadcast relay and sound distribution.

D.C. SUPPLY. Two publications, by Elliott Brothers (London) Ltd., Century Works, Lewisham, London S.E.13, deal with the high stability d.c. supply unit and a low level d.c. amplifier produced by the company.

FLUORESCENT FITTINGS. A broadsheet revised in January has been issued by Ekco-Ensign Electric Ltd., Southend-on-Sea, Essex. It deals with the complete fluorescent lighting range for every modern lighting requirement which is supplied by them.

DUST COLLECTORS. Publication by Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London E.C.4, now available is No. 6902 which deals with the high efficiency scientific cyclone unit.

Measurement Section Papers

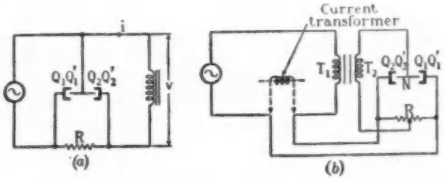
Discussion on the Testing of Fine Wires and Use of the Electrostatic Wattmeter

AT a joint meeting of the Measurement and Radio Sections held at the I.E.E. last Tuesday, two rather dissimilar papers were presented: "The Use of an Electrostatic Wattmeter for Magnetic-Loss Measurements," by J. K. CHOUDHURY and ARVON GLYNNE, and "The Testing of Fine Wires for Telecommunication Apparatus," by R. C. WOODS and J. K. MARTIN.

Magnetic-Loss Measurements

The authors of the first paper pointed out that wattmeters required for iron-loss measurements needed to record powers ranging from a few microwatts to many watts, at frequencies varying from a few cycles/sec up to one Mc/sec. Although about twenty years ago the electrostatic wattmeter was frequently used as a laboratory instrument, its use was comparatively infrequent today. However, some experiments had shown that a simple form of electrostatic wattmeter could be employed to measure iron losses of a few microwatts upward, at frequencies between 25 c/s and 25 kc/s.

The basic circuit of the wattmeter is shown below. The potential difference between quadrants Q_1, Q_1' and Q_2, Q_2' is iR and is thus proportional to the instantaneous current in the winding of the magnetic specimen, while that between the needle and Q_2, Q_2' is v volts and between the needle and quadrants Q_1, Q_1' is $(v+iR)$ volts.



If the rate of change of capacitance, with rotation of the vane or needle, between needle and Q_1, Q_1' and Q_2, Q_2' are $dC_1/d\theta$ and $dC_2/d\theta$, the instantaneous torque is:—

$$\frac{1}{2}\frac{dC_1}{d\theta}(v+iR)^2 + \frac{1}{2}\frac{dC_2}{d\theta}v^2$$

By arranging that $dC_1/d\theta = -dC_2/d\theta = dC/d\theta$ the torque becomes $k\,(vi + \frac{1}{2}i^2R)$

where $k = \dfrac{RdC}{d\theta}$

Thus the rotation of the needle is proportional to the mean power supplied to the specimen plus half the loss in the quadrant resistor. This latter can be measured by connecting the needle to Q_2, Q_2' when the torque is given by $\frac{1}{2}\,ki^2R$.

By modifying the circuit as shown in (*b*) the magnetic loss can be measured directly without allowance having to be made for the copper loss or for the term $\frac{1}{2}\,i^2R$. Further, by introducing voltage amplifiers to supply the needle and quadrant potential difference the sensitivity could be greatly increased without the necessity of making R great.

The authors continued by giving details of the amplifiers and the performance of the complete set-up.

Testing of Fine Wire

The second paper was concerned with quality testing of enamelled wires of diameters between 0·002 and 0·010 in. Prior to 1939, the telecommunication industry had available an adequate supply of natural-silk-covered—a reliable and closely controlled product; post-war conditions, however, had led to the utilisation of large quantities of enamelled covered wire.

Although B.S. 156 : 1943, had set down criteria for testing, these did not give any definite information on quality. The authors then described the methods of testing for dimensions, elongation and breaking, resistance to abrasion, electrical film strength and pinholes, in considerable detail and concluded that reliable routine inspection was limited to dimensional measurement, visual examination and the pinhole test only. They suggest that the deficiencies in existing test methods should be more generally recognised as a first step toward improvement.

DISCUSSION

Iron-Loss Measurement

MR. R. S. J. SPILSBURY (N.P.L.) said that for audio-frequency testing, and especially for tests of iron loss, the electrostatic wattmeter had certain advantages: its power demand was low; its frequency range was great; it was almost independent of power factor, and it had an enormous power range—they found that they could easily cover a power range of 10 MW to 1,000 MW.

MR. J. K. WEBB (Standard Telecommunication Labs. Ltd.) congratulated the authors on giving the electrostatic wattmeter "the new look." They had succeeded in covering a useful frequency range, but he wondered why it could not be extended even higher by modifying the amplifier design. He gave suggestions for doing this.

MR. S. E. BUCKLEY (Standard Telecommunication Labs. Ltd.) remarked that by many engineers the quadrant electrometer was regarded as somewhat academic, but the authors had shown that it could be used very effectively.

MR. F. R. AXWORTHY (Everett Edgcumbe) said that the authors had made a valuable contribution to the art of measurement by showing that an electrostatic wattmeter could be made which was robust, portable, simple and worked very well.

MR. J. MACFARLANE (Guest Keen and Nettlefolds) said that as a user of dynamometer wattmeters he found it possible to work with errors not exceeding 1% at 10 kc/s, and up to that figure at any rate he would prefer to use the robust dynamometer instrument rather than the electrostatic one.

MR. T. H. WALKER (Standard Telecommunications) suggested that amplifiers of the maximum feedback type, giving uniform feedback over the whole of the useful range, might well be the most suitable type for the authors' purpose.

DR. J. H. MOLE confessed to disliking a measuring instrument which included amplifiers as a basic portion of it.

MR. J. H. KAYSER suggested that there would be an application for the authors' instrument for making measurements at high flux densities at 50 c/s where the power factor was very low and the dynamometer was liable to give erroneous readings. The authors briefly replied.

Fine Wires

MR. W. E. WRIGHT (Conollys Blackley Ltd.) said that tests which he had carried out confirmed the authors' finding that the frequency/breakdown voltage curve of enamelled wire was bimodal. The most important factors controlling the breakdown voltage of enamelled wire were slivers and imperfections of the bare wire, and mechanical damage of the enamel. The revised B.S. 156 would specify a minimum thickness of insulation for each size of wire, to ensure that average slivers were well covered with enamel and that any undamaged wire would have a satisfactory breakdown voltage.

MR. A. M. MORGAN (Enfield Cables) contended that the experimental evidence given in the paper did not support the authors' hypothesis and gave reasons for his inability to accept the arguments by which the authors explained the bimodal nature of their curves.

MR. PETER LEWIS said it would help users if the manufacturers of wires would give details of the materials which should not be used in conjunction with them, to avoid chemical attack.

MR. R. C. WOODS briefly replied.

RAILWAY ELECTRIFICATION

1,500 Volts Overhead for Future Development

AS we go to press, the report of the committee appointed by the Railway Executive and the London Transport Executive to consider railway electrification has come to hand. Owing to space considerations, it is impossible to deal with this fully in this issue, and a more comprehensive review will be given next week.

As was to be expected, the committee's report confirms the conclusions of the Pringle Committee's report of 1927, and recommends that the 1,500 V d.c. overhead-line system should be standard for all future electrification schemes in this country, except as regards an area to be earmarked for the third rail system of the former Southern Railway.

In coming to this conclusion, the financial implications of working with 750, 1,500 and 3,000 V d.c. and 20 kV 16⅔ c/s a.c. have been analysed. It has also been deduced that it is uneconomical to convert to electric working, lines with a traffic density of less than three to four million trailing tons per mile of single track, per annum. A map is included in the report giving the traffic densities of the main line systems, and it is noteworthy that the great majority of trunk routes carry densities of over 4,000,000 trailing ton miles per mile of single track.

On the question of voltage selection; it is pointed out that at the traffic densities on those lines likely to be electrified, the economic advantage of 3,000 V d.c. over 1,500 V d.c. is very small, and that fact, coupled with the existence of lines already working at 1,500 V makes it preferable to adopt the lower value.

On operating grounds, the report states, it is desirable and economically necessary to retain the existing conductor rail system of the Southern Region and elsewhere, and there are also good reasons for retaining the fourth rail system in the extensive network of single track tunnels with a dense train service, of the London Transport.

THE WEEK

COMMERCE *in news* INDUSTRY

London Electricians' Strike

THE strike of electricians employed in the contracting section of the London Electricity Board, which started on February 14, shows no sign of settlement despite official intervention. On Wednesday of last week, the National Joint Industrial Council for the Electricity Supply Industry, after a meeting at the B.E.A. in London, advised the men involved to resume work immediately so that any dispute could be settled within the machinery laid down by the N.J.I.C. The following day, Sir Robert Gould, chief industrial commissioner at the Ministry of Labour, intervened, asking representatives of the Board and the unions concerned to meet him to discuss the position. On Thursday last, 1,684 men were involved. It will be recalled that the strike started at Bethnal Green when 17 electricians stopped work because a new mate was appointed who was not a member of the E.T.U. but of the T. and G.W.U.

Plant Engineers' Conference

BUXTON has been selected as the home of the Fourth Annual Conference of the Institution of Incorporated Plant Engineers, which is to be held on May 22, 23 and 24. Business to be conducted includes a branch secretaries' conference, installation of Mr. D. Lacy-Hulbert as the fifth president, and a general discussion on Institution affairs. On the last day there will be an address by Mr. Oliver Lyle. A full programme of entertainments has been arranged to accompany the official business and further details of the conference can be obtained from the General Secretary of the Institution at 48 Drury Lane, Solihull, Birmingham.

Festival Radio Convention

THE British Institution of Radio Engineers has announced a broad programme of the Radio Convention to be held during the summer months. Unlike its predecessor at Bournemouth in 1947, the convention's six sessions will be staggered over the Festival period and venues will be in London, Cambridge and Southampton. Over 70 papers are to be read during the conference. The first two sessions on "Electronic Instrumentation in Nucleonics" and "Valve Technology and Manufacture" will be at University College, London, between July 3 and 6. From July 24 to 27 papers on "Radio Communication and Broadcasting" and "Radio Aids to Navigation" will be read at University College, Southampton. The fifth session will be at King's College, Cambridge, between August 21 and 24, when the subject will be "Television Engineering," and the final session on "Audio Frequency Engineering" is to take place at Earls Court (London) from September 4 to 6.

Power Developments in Australia

THERE are a vast number of projects in hand or contemplated in Australia for the expansion of the Commonwealth's public utility services. Those connected with the electricity supply industry have been already noted in our pages, but the Board of Trade has recently issued in full a report prepared by the Australian Ministry of National Development, which lists all the major projects. These include electric power, fuel, water and irrigation works, to cost over £500,000, which are in advanced stages of planning or being undertaken at the present time by the State and Commonwealth Governments. Contractors and manufacturers should find the list useful.

50 Years of Electrical Progress

HALF a century of progress in electrical engineering and science is now being portrayed at an exhibition in Birmingham staged as part of the golden jubilee celebrations of the I.E.E.'s S. Midland Centre. Each of the centre's four sections—measurements, supply, utilisation and radio—has been allocated a part of the exhibition. In the measurements section, for instance, can be seen some of the instruments used for measuring electricity supply to the consumer of 1901. A working model of a modern machine shop is another highlight of this part. Old and new methods of lighting form the utilisation section.

The First Half-Century

It was interesting to watch the faces of the crowded audience during the reading of the paper on polyphase substation machinery. No one had read it before; no one understood it except in parts; but nearly all wanted to know something about its subject, so that the general expression was one of unintelligent curiosity. There was a large contingent of Finsbury students—for Dr. S. P. Thomson was going to speak. I hope they appreciated what they heard. The author tried to read the paper in abstract, but he could do nothing of the kind. He could only throw large chunks of it at the heads of the audience.—*From our issue of March* 21, 1901.

while the radio exhibits give a brief history of development in all branches of electronics, telephony, radio and television. Models of modern power stations serve to indicate the complicated and intricate machinery operating today compared with generators in use at the turn of the century. The exhibition, which is at the College of Technology, Suffolk Street, will be open to the public free of charge until March 31, the holidays excepted.

Power Cut Radio Warnings

A DEMONSTRATION of new equipment, designed to give warnings of load shedding by radio, was carried out last week at Yeadon. As reported in our issue of February 1, the Yorkshire Electricity Board has been experimenting on a radio warning system for industrial consumers, and further details were given in our issue of February 15. Board officials are hoping that it will be possible to link about 500 of the Area's 17,000 industrial consumers with the scheme later this year. The works of J. B. Battye and Co., Ltd., was used as the guinea pig for the trials, and the signal was given from the Thornhill transmitter, about 14 miles away. Normally, the signal would be given from a transmitter at Otley Chevin, only two miles away. The trials were successful and a full report is to be sent to the B.E.A. It seems very likely that the same system will be adopted throughout the country.

Mobile Service Centres in N.W.

THE small but important industrial town of Littleborough, about four miles from Rochdale, has now got its own service centre. So far the N.W. Electricity Board has been prevented from establishing a permanent building in the town and has therefore set up a mobile centre on a site in Railway Street. It is one of four which are being commissioned for similar localities.

It is planned to give as complete a service to local consumers as possible. Standard types of domestic equipment are on show and regular demonstrations are being given to Littleborough housewives. The exterior is of extruded aluminium and inside it has been veneered in light oak with a rubber floor. The whole is lit by peach colour fluorescent lighting units.

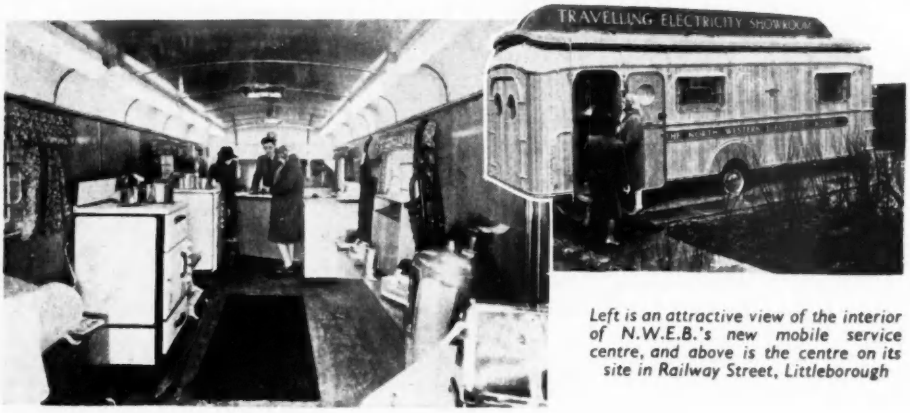
Festival Electric

OVER 3,000 electrical appliances will be exhibited by some forty manufacturers at the Festival exhibition to be held at Dundee from April 10 to 14 by the North of Scotland Hydro-Electric Board. Designed to show the efficiency of electricity in its many and varied modern applications, it will nevertheless emphasise the fuel economy aspect.

Programme for Brighton

FULL details of the 1951 British Electrical Power Convention, to be held at Brighton on June 18-22, have now been arranged by the Convention Council, and the list below adds information to the preliminary summary given in our issue of February 1.

Monday, June 18	The Dome 10 a.m.-5 p.m. Floral Hall, 4 p.m. Royal Pavilion, 8 p.m.	Issue of badges. Sir Henry Self opens Electrical Exhibition. Reception by Mayor.
Tuesday June 19	The Dome, 10 a.m. 2.30 p.m. Corn Exchange, 8.15 p.m.	Civic welcome and presidential address. "Electronics," by Mr. O. W. Humphreys. Reception by President.
Wednesday June 20	The Dome, 10 a.m. 2.30 p.m.	"Electricity as a National Asset—its uses and application," by Messrs. N. Elliott and H. H. Mullens. Sea trip and visits.
Thursday, June 21	The Dome, 10 a.m. Royal Pavilion, 4 p.m. Corn Exchange, 7 p.m.	"A Survey of the Refrigeration Industry," by Mr. E. G. Batt. Ladies' tea—to meet Lady Self. Annual dinner.
Friday, June 22	The Dome, 10 a.m. 11.30 a.m.	"Electricity—a factor in Social Progress," by Dame Caroline Haslett. General meeting of delegates.



Left is an attractive view of the interior of N.W.E.B.'s new mobile service centre, and above is the centre on its site in Railway Street, Littleborough

Mr. R. E. Tucker, chairman, and Mr. R. E. B. Harris, secretary of the E.W.F. S.W. and S. Wales section holding the E.I.B.A. Rose Bowl presented to the section at the Federation's annual dinner last week. The bowl is presented annually to the E.W.F. section which contributes most towards E.I.B.A. funds

Students' Section Dinner

SIR JOHN HACKING, vice-president of the I.E.E., was principal guest at the second post-war Annual Dinner of the London Students' Section, held at the Institution building under the chairmanship of Mr. I. J. Shelley. Replying to the toast of the Institution, which was proposed by Mr. B. L. A. Ellings (hon. secretary), Sir John recalled his chairmanship of the N.E. Students' Section in its second year of existence. He went on to speak of the continued interest of the Council of the Institution in its junior members and of the efforts made to keep the standard of corporate membership high, so that students and graduates should, in their time, accede to a distinction well worth having. Besides Sir John, the section entertained as guests Dr. J. A. Saxton, Mr. J. H. Reyner (editor of the Students' Quarterly Journal), Mr. F. Jervis Smith (deputy secretary, I.E.E.) and Mr. J. N. Ratcliffe (I.E.E. staff).

Power Stations too Elaborate

DOMESTIC consumers in S. Wales will have to pay one-tenth of a penny more for electricity as from the first meter reading after April 1. The increased charges will not affect industrial consumers subject to coal-price clauses and those already paying 3d. per unit. The announcement was made at a meeting of the Area's Consultative Council last week. After commenting that they had had a bitter pill to swallow, the Council's deputy chairman, Mr. C. L. Hilton, went on to criticise the erection of elaborate power stations. The capital charges on some of the buildings, which were more expensive than the plant they housed, were a big factor in the increase, he said. Other members supported this view and it was decided to express to the B.E.A. the Council's concern at the high cost of generating stations.

Revised Non-Ferrous Scrap Prices

THE Minister of Supply has made a new order to overcome certain anomalies in scrap metal trading and to remove difficulties which have prevented the free flow of non-ferrous scrap to industry. Main alterations, which came into force last Saturday, are that the maximum commission for merchants has been increased from 2% to 3% on all materials except lead, and the maximum charge for bagging is increased to 1s. 6d. per bag or 25s. per ton, whichever is least. The order also authorises a charge not exceeding 25s. per ton for briquetting. Provisions relating to invoices have been amplified. There are also some changes in the prices of copper, lead, brass and cupro-nickel, all of which are contained in the Non-Ferrous Metals Prices (No. 2) Order, S.I. 1951, No. 425, which is obtainable from H.M.S.O.

Public Speaking on Leisure Hours

CANDIDATES to represent the N.W. Area in E.D.A.'s public speaking competition to be held in London on April 12 have been decided. Winners of the area finals in both the men's and women's sections chose "Leisure Hours" as the subject of their addresses. It would appear that people are far more eager to talk about the time they spend off-duty than about their work, for winners in the N.E. Area's contest also chose to speak of their leisure hours (see our issue of February 15). Other set subjects were "Electricity and Transport," "Safety" and "Artificial Illumination." Winners in the N.W. were Miss Patricia Owen, a demonstrator at the Disley service centre, and Mr. Wilfred Butlar, secretarial assistant at the Oldham Sub-Area headquarters.

Brochure on Annual Report

THE practice of publishing brochures showing the financial activities of firms seems to be becoming more widespread. The latest to reach us is that of the Lancashire Dynamo Holdings Ltd. The annual report for 1950 to shareholders and employees, including statement of accounts, has been attractively laid out in an 18-page booklet. Incidentally, this is the first time that the company has produced a brochure of this kind. The report will be presented at the fifty-second ordinary general meeting of members on April 3. Financial results are given in "Company Activites" on page 503.

Metrovick lanterns have been fixed to existing trolley-bus standards in this installation along the Great North Road on the outskirts of Newcastle

Street Lights on Trolleybus Poles

FOR reasons of economy and to reduce to a minimum the number of standards along a particular road, many authorities make use of existing trolleybus poles for street lighting purposes. An instance of this was along the Great North Road on the outskirts of Newcastle-on-Tyne where Metropolitan-Vickers' "S.O. Fifty" lanterns were employed. The lanterns contain 140 W sodium lamps and the whole unit has proved entirely suitable for this application where severe vibration and shock are always encountered. Despite the exceptional width of the road, which accommodates a dual carriageway and two trolleybus tracks, the whole area has been well lit and the kerb-line clearly defined.

Three Million Motors in 50 Years

IT was a great day at the Coventry works of British Thomson-Houston Co., Ltd., on Tuesday of last week when the three millionth fractional h.p. motor came off the production line. The final assembly, testing and packing of the all-important product was seen by the Mayor of Coventry, Ald. Joseph Howat, who was afterwards entertained to a celebration lunch by the company. The motor will not remain in this country, however. It so happened that it was one of a batch of 5,000 ¼ h.p. 110 V induction motors for a repeat order received recently from the Canadian General Electric Co.

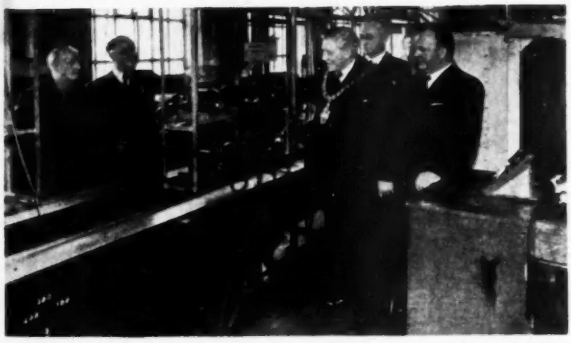
The demand in this country for small electric motors really began, although on a limited scale, at the turn of the century, so that the production of the three millionth motor has an added significance in that the figure has been achieved in half a century. To commemorate this feat B.T.H. has produced a small booklet which sets out the company's progress in development and manufacture during those 50 years.

Prices of Nuts and Bolts

THE maximum prices of certain types of bolts, nuts, studs, screws and rivets have been increased under an order made recently by the Ministry of Supply. The latest order, which came into force last Friday, consolidates the previous one controlling these commodities and covers all items specified in those orders except aircraft bolts, nuts and screws. Copies of the Bolts, Nuts, etc., Prices Order, 1951 (S.I. No. 404), are obtainable from H.M.S.O.

Ancient Electric Railway Scrapped

LAST week was a sad one for all those in N. Ireland who have a soft spot for railways, from the highest executive to the schoolboy collecting train numbers. The Giant's Causeway Railway was auctioned and buried in the melting pot for the undignified grave of a scrap metal heap. Electrical engineers also may have shed a small tear for the miniature railway which jogged along eight miles of the Antrim cliffs, as this was the oldest hydro-electric railway in the world. Local bodies, museum authorities and antiquarians were as indignant at its destruction as their fathers and grandfathers were 70 years ago when the railway was built. What was once a danger to life and limb, employing the new-fangled electricity, came to be regarded as a monument to the progress of man. Nevertheless, the authorities decided it should be scrapped and there was no reprieve.



The Mayor of Coventry, with Mr. E. H. Ball, managing director of B.T.H., inspecting the three millionth motor on endurance test

Social Miscellany

LAST but by no means least in the news this week is the miscellany of items unrelated to the day's work, but nevertheless of importance to electrical engineers. We note that Mr. W. J. Terry, managing director of Liverpool Electric Cable Co., Ltd., Mr. G. E. Jewell, director, and Mr. F. W. Freeman, director of an associate company, made a special trip from London to attend the staff annual dinner at the Exchange Hotel, Liverpool. Mr. Terry had an added reason for going as during the evening he was presented with a pair of gold cuff-links as a memento of the firm's golden jubilee.

Old Faradians gathered at the Faraday House Electrical Engineering College recently for a cocktail party on the occasion of the Old Students' Association's annual meeting. Mr. J. C. Thompson, assistant director electrical engineering, Admiralty, was elected president for the ensuing year. While on the subject of past students' associations, we note that The Old N'Ions (Northampton Engineering College) have issued their calendar for the 1951 session. E.I.B.A. funds have been bettered to the extent of £239, realised through the cricket bat, autographed by the M.C.C. and West Indian cricketers last year, and given to the Association by Mayfair Electric Ltd. Another success has been chalked up by Johnson and Phillips' Victoria Works Athletic Club. Latest presentation of the Amateur Dramatic section was "Easy Money."

Despite the inclement weather, over one hundred people had a most enjoyable evening at a dance held by the Sloan Electrical Co.'s Social Club at the Royal Hotel last Friday. Representatives of some of the larger electrical engineering interests were among the guests.

NEWS IN BRIEF

Swan Hunter and Wigham Richardson, Ltd., Walker-on-Tyne, have started work on a 2,500-ton cable-laying ship for Cable and Wireless. Ordered last October, the vessel will have a range of about 10,000 miles.

The Birmingham Electric Club has arranged that its next golf competition meeting will take place at Edgbaston Golf Club on April 23.

In our article on the control board for the New Port grain elevator in Buenos Aires, published in our issue of March 15, the total value of the contract was incorrectly stated to be £270,000. This figure was, in fact, the value of the subcontract for which the G.E.C. was responsible. The main contract, awarded to Simon Handling Engineers Ltd., was worth approximately £2 million.

Questions in Parliament

Increased Costs

The Chancellor of the Exchequer was asked if he was aware that each nationalised industry had, in the past 12 months, increased the charges for its services on the ground, among others, that the costs of services provided for it by other nationalised industries had increased; and what steps he was taking to counteract the effect of those increased charges upon the cost of living? Mr. Gaitskell replied that the general rise in industrial costs both in private and nationalised industry had been mainly because of higher prices for imports and to a smaller extent because of higher wages. The steps taken by the Government to control the rise had been repeatedly explained.

Electricity Costs

Mr. T. Reid asked the Minister of Fuel and Power for the average cost of electricity to domestic and industrial consumers before nationalisation and at the present time? Mr. Noel-Baker stated that the average revenue p.u. sold for lighting, heating and cooking (including supplies to shops, offices, hotels, etc.), was 1·391d. in 1947 and 1·504d. in 1949. The average revenue p.u. sold for power was 0·907d. in 1947 and 0·940d. in 1949. He agreed that the increase in costs was much lower than the average increase in costs in industry, being less still compared with 1938. Mr. Pickthorn then asked if there was information which would show how much costs had been increased by unpredictable variation in voltage; and how much real costs had been increased to the consumer? Mr. Noel-Baker agreed that the loss to industry had been considerable but he could make no reliable estimate. He would also consider the suggestion that before electricity prices were increased notification be sent to local authorities.

Television Stations

During discussions on television, Mr. C. R. Hobson, assistant Postmaster-General, stated that in the light of the defence programme, it had been decided that the high power stations at Holme Moss, Kirk o'Shotts and Wenvoe should be completed, but the five low-power stations (Newcastle, Southampton, Belfast, Aberdeen and Plymouth) should be postponed indefinitely.

Fuel Economy—Westminster

Giving details of the economies in the use of fuel and electricity now practised in the Palace of Westminster, Mr. Stokes said these had resulted in a 10% saving on electricity and 5% on heating.

Hearing Aids

Responding to questions by Mr. Erroll and Dr. Hill, the Minister of Health said that 118,699 patients had been supplied with Medresco hearing aids, and evidence derived from a recent survey suggested that about 90% continued to use them

regularly. He expected deliveries to distribution centres would continue at the rate of over 6,000 a month during 1951, but some of these would be required as replacements. The services of research development and distribution were so widely spread over various Government agencies that he could not give any useful figure of total costs.

Iron and Steel Scrap Prices

Seeking the annulment of the Iron and Steel Scrap Order, 1951, S.I. No. 1951, Wing Commander Bullus asked if the increased prices were due to the shortage of the raw material. He suggested that the present increases were due wholly to the Government's policy in the past. Replying, Mr. Freeman, Parliamentary Secretary to the Ministry of Supply, explained that the Order gave an increased commission of 1¼% on the commissions allowed to scrap merchants. It was necessary for two reasons. Firstly, the commission had not been increased since 1940; it seemed reasonable to allow an increase because prices had risen considerably during that period. Secondly, it was desired to give dealers every incentive to bring in every ton of scrap they could. But the increase is approximately one-eighth of 1% of the price of ingot steel, and is not reflected in any increase in the price of steel. The question was negatived.

Wood Poles

The Minister of Fuel and Power was asked if he was aware that the South Western Electricity Board were refusing to buy home-grown timber transmission poles, on the ground that they were only interested in imported red fir; and if he would include in the allocation of poles to the B.E.A. a proportion of home-grown timber poles? He denied that the Board had made such a refusal, since they had not been offered home-grown poles. Imported red fir had a much longer life. The allocation of poles to users was already made on the basis of merchants' stocks, which included imported and home-grown poles, and it would not be practicable to stipulate what proportion of home-grown poles the electricity boards should take. Mr. Thornton-Kemsley then asserted that the Board were offered and refused home-grown poles, and Mr. Noel-Baker agreed to look into the matter on receipt of other information.

Electric Supply News

Chester

Built almost forty years ago, the hydro-electric station at the foot of the Old Dee Bridge, Chester, is to be closed as a generating station at the end of the month, because it is no longer an economical proposition. New pumping machinery is to be installed to supply 5,000,000 gallons of water a day from the Dee to Capenhurst Atomic Research Station under the recent West Cheshire Water Board Order.

Douglas (I.O.M.)

The Town Council has agreed, at a special meeting, to a 5% increase on all electricity tariffs.

Fleetwood

The North Western Electricity Board is preparing to lay 1,130 yards of 33 kV submarine cable across the River Wyre to Preesall.

Hackney

A further extension of the Hackney power station is under consideration by the B.E.A. For this it is proposed to acquire about seven acres of land, now part of Hackney Marsh. The existing station adjoins Hackney Marsh, and, as compensation the B.E.A. propose to give in exchange other land, contiguous, of at least equal value. The London County Council Parks Committee has reported that the only means of solving the difficulty has been to enlist the co-operation of the Metropolitan Water Board, from which the compensating land has been purchased by the Authority. The area taken for the extension project will be mainly used as a coal stockyard, with one cooling tower. Among the precautions to prevent inconvenience to users of Hackney Marsh, it has been stipulated that the stockpile shall not normally be drawn upon when there is play on the neighbouring football and cricket pitches, and that the best possible type of electrostatic grit arresters shall be installed in the new power station.

Malvern

A second public inquiry is to be held by the Minister of Fuel and Power on April 3 into the revised proposals of the Midlands Electricity Board to erect a 66 kV line across the Malvern Hills into Herefordshire. It will be recalled that the original proposals were rejected by the Minister. The revised scheme is for the pylons to cross the hills near the Pink Cottage instead of near the British Camp, but there is again to be strong objection, we understand.

Smethwick

A new network of cables now being laid throughout the borough will enable supplies to two-thirds of Smethwick, now receiving direct current electricity, to be changed in the next five years to alternating current. About 7,000 consumers, including 6,000 houses, are involved in the £200,000 operation. Coupled with the change is a new street lighting scheme.

Scotland

Plans to build a new power station in the Alloa-Stirling area, adjacent to the coalfields, and the possibility of a further power station being erected at Blythswood, on Clydeside, were mentioned by Sir John Hacking, deputy-chairman (operation), of the B.E.A., in a letter to the Lord Provost of Glasgow, which was considered last week by the

Corporation Special Sub-Committee on Electricity. Sir John, who was reporting on the country's power supply and answering complaints from industry and commerce on load-shedding, expressed the view that the power position next winter would be much improved so far as the West of Scotland was concerned, and there might not be the same deficiency in output because of the increased plant which would be coming into commission. The generating capacity of the country under favourable conditions should be increased by 500,000 kW by the end of 1953. Should the higher rate of commissioning and average weather prevail, this problem would approach solution by 1954-55.

On the other hand, if the lower rate of commissioning prevails then the problem will not be solved until 1957-58. Severe weather conditions can very materially affect these calculations. It was the Authority's intention to press on with the completion of the Braehead power station, near Glasgow; to plan and build a new power station in the Alloa-Stirling area, so sited on account of the cost of coal, and to give consideration to the building of yet a further power station at Blythswood, Sir John added.

LIGHTING SCHEMES

Belfast.—The Corporation is to extend its mercury vapour street lighting.

Folkestone.—The Highways and Buildings Committee has reported that agreement has at last been reached with the Ministry of Transport concerning the tendering for the supply and erection of the new lighting on Sandgate Hill.

Fylde.—The R.D.C. is seeking a loan of £2,236 for the installation of 42 street lamps at Bryning-with-Warton.

Ilfracombe.—The U.D.C. is to invite tenders for floodlighting Southern Slope and the Garden of Remembrance.

Portsmouth.—The Corporation is to repurchase the electric street lighting equipment from the Southern Electricity Board at a cost of £15,120.

St. Marylebone.—New street lights are to be erected near St. Marylebone Council flats on Barrow Hill and Church Street estates at junctions of Barrow Hill Road and Bridgeman Street, Charlbert Street and Allitsen Road, and Penfold Street and Luton Street.

Company Activities

Lewis Berger & Sons

Consent of the Capital Issue Committee has been received for half the scrip bonus for which permission was sought by the directors. Sanction was sought for the capitalisation of £1,054,550 for a two-for-one distribution, but permission has been given, however, only for one new 4s. Ordinary share for every 4s. of Ordinary stock held on March 27, capitalising £572,275 of the reserves. The new shares rank immediately for dividend.

Bylock Electric Ltd.

For the year to July 31, the net profit before tax was £1,625, against £14,986 for the preceding year. Taxation takes £1,333 (*£7,276*), and there is added, taxation reserve no longer required £998. There is again no dividend. But trading for the half-year ending January 31, 1951, appears to have been satisfactory, so an interim for the year to July 31, 1951, of 25%, is declared.

Ericsson Telephones Ltd.

Net profit for 1950 is £532,614 (*£486,918*). The final Ordinary dividend is again 12%, but the bonus is increased from 3% to 5%. Taxation absorbs £615,609 (*£554,153*). The sum of £396,880 (*£400,000*) is placed to general reserve.

International Combustion (Holdings)Ltd.

The consolidated trading profit for the year to September 30 last is £902,928, as compared with £572,841 for the previous year, with £20,422 (*£23,123*) other income, the total is £923,350 (*£595,964*). Taxation absorbs £531,377 (*£345,073*). The holding company's net profit is £131,985 (*£228,306*). After payment of dividends, there is carried forward £149,078 (*£118,758*) by the holding company, and £18,373 (*£14,776*) by the subsidiaries. Consolidated current assets are listed at £6,537,057 (*£5,579,248*), and current liabilities and provisions £4,879,799 (*£4,287,360*).

Lancashire Dynamo (Holdings) Ltd.

Consolidated trading profit for 1950 is £478,839 (*£384,639*), plus investment income £13,390 (*£11,862*), making £492,229 (*£396,501*). Depreciation takes £47,814 (*£42,747*), directors' emoluments £42,723 (*£36,743*), and taxation £224,287 (*£166,017*), leaving a net profit of £177,405 (*£150,994*), to which is added £37,350 (*nil*) taxation provisions of previous years no longer required, making £214,755 (*£150,994*). With £308,702 (*£241,678*) brought in, there is £523,457 (*£392,672*) available. Dividends absorb £71,831 (*£63,016*), to staff pension scheme nil (*£20,000*), to reserve in subsidiary £3,453 (*nil*), leaving £422,660 carried forward by Lancashire Dynamo Holdings, and £24,967 by subsidiaries.

Richardsons, Westgarth and Co.

Approval was given by the shareholders last week to an increase in the company's capital from £1,120,000 to £1,600,000 by the creation of 1,920,000 5s. shares. Ordinary stockholders will be offered 1,061,616 of the new shares at 8s. 3d. each, in the proportion of one new for each four stock units held.

Dividend Declared

Rheostatic Co. Final Ordinary dividend of 12½% (*10%*), making 16½% (*16%*). Net profit £31,308 (*£25,610*).

Commercial Information

CONTRACTS OPEN

HOME

Mar. 22.—Belfast. Electrical installation in Museum and Art Gallery in Stranmillis Rd. City Surveyor's Dept., architectural section, City Hall.

Mar. 22.—Cuckfield (Sussex) R.D.C. Installation of electricity in existing council houses on seven different sites. Engineer and Surveyor, A. Hutchings, Rural Council Offices. Deposit 10s. 6d.

Mar. 23.—Bedworth U.D.C. Supply of electric lamps and dry batteries for year ending Mar. 31, 1952. Engineer and Surveyor, 134 Newtown Rd., Bedworth.

Mar. 23.—Ulster. Supply of steel conduit and fittings for electric wiring, cables and electric lamps for year ending March 31, 1952. Stores Superintendent, Duncrue St., Belfast. Charge of 1s. for each tender form.

Mar. 24.—Bradford. Supply and installation of new switchgear and wiring at Dumb Mills, Frizinghall, and dismantling and removal of redundant portions of existing switchgear. City Engineer and Surveyor. Deposit £2 2s. (See Feb. 22 issue.)

Mar. 24.—Edinburgh. Installation of electric light in alterations of Cannogate/Tolbooth property. Also rewiring of City Chambers. Separate contracts. Office of City Architect, City Chambers.

Mar. 26.—Litherland U.D.C. Electrical installation at public slipper baths. Engineer and Surveyor, Town Hall, Litherland, Liverpool 21.

Mar. 26.—Rothwell U.D.C. Electric wiring in 12 houses at Woodlesford. Documents from the Architect, Civic Bldgs., Rothwell, Leeds.

Mar. 27.— Boldon (Durham) U.D.C. Erection and installation of street lighting at Boldon Colliery, consisting of 83 140 W sodium lamps and 94 100 W metal filament lamps. Engineer and Surveyor, N. Hindmarch, Council Offices, East Boldon.

Mar. 27.—Paisley T.C. Electrical work in erection of 96 flats at Blackhall. Master of Works, John A. M'Gregor, 14 Gilmour St., Paisley.

Mar. 27.—Ilford T.C. Electrical installation for lighting, heating, power, bells and radio at the Newbury Park junior mixed school. Borough Engineer, Town Hall. Deposit £2 2s. (Advertised in this issue.)

Mar. 27.—Waterford. Installation of internal communication systems in County Hospital, and Fever Hospital, at Waterford and County Home and District Hospital at Dungarvan, for Board of Public Assistance. Secretary is J. K. O'Hare, Davitt's Quay, Dungarvan.

Mar. 28.—Feltham U.D.C. Installation of electric lighting in 181 council houses. Engineer and Surveyor, Lynton House, Hanworth Rd. Deposit £2 2s.

Mar. 28.—Goole T.C. Electrical work in erection of 31 houses and 8 bungalows on five sites, and 23 houses and 2 bungalows in Empson Ave. Thos. Waterfall, Borough Surveyor, Municipal Offices. Deposit £2 2s.

Mar. 28.—Kincardine. Installation of street lighting at Cove Bay comprising 21 100 W lamps mounted on pole brackets. County Road Surveyor, Viewmount, Stonehaven.

Mar. 28.—Manchester. Supply of glass globes and street lighting lanterns for period July 1 to Dec. 31. City Surveyor, Town Hall.

Mar. 30.—Belfast. Re-plating of lead-acid storage battery. Electricity Dept., East Bridge St., Belfast. Deposit £1 1s. (See Mar. 8 issue.)

Mar. 30.—Dublin. Supply of 1,000 yd of 1·5-2 core rubber, lead and armoured cable. City Engineer's Office, 28 Castle St., Dublin.

April 2.—Droitwich R.D.C. Supply and erection of two electric motor and centrifugal sewage pump sets, each capable of delivering 9,000 g.p.h., and two capable of delivering 4,000 g.p.h. Council's Consulting Engineer, A. Brooksbank, 14 The Exchange, Bradford, Yorks. Deposit £2 2s.

April 2.—Bacup T.C. Supply, delivery and erection of street lighting equipment in Market St. and Newchurch Rd. (A681). E. Hutchinson, Town Clerk, Stubbylee Hall, Bacup. Deposit £2 2s.

April 2.—West Riding. Electrical installation at Holmfirth modern school. County Architect, "Bishopgarth," Westfield Rd., Wakefield.

April 2.—Wrexham R.D.C. Wiring for electric light and power of 48 houses at Broughton and 50 at Gwersyllt. Engineer and Surveyor, D. E. Edwards, Imperial Bldgs., Regent St., Wrexham. Deposit £2 2s.

April 3.—Sheffield. Supply of 500 kW rectifier equipment complete with switchboard, circuit breakers, cables and connections, for refuse disposal works in Bernard Rd. Cleansing Superintendent, Town Hall. (Advertised in this issue.)

April 4.—Wandsworth. Supply and delivery to Tooting Depot, Greaves Place, of 10,800 ft of 3·029 S.W.G. armoured cable in various lengths of between 2 and 12 core cable. Borough Engineer, Surveyor and Architect, Municipal Bldgs., S.W.18. (See Mar. 8 issue.)

April 6.—Aberdeen. Electrical work in (*a*) 4 houses at Howford, (*b*) 6 houses at Cluny, (*c*) 16 houses at Kenmay. County Architect, 25 Union Terrace, Aberdeen.

April 7.—Hyde T.C. Supply and erection of 156 Class A street lighting units including columns, lanterns, lamps and starter gear. along A.57. Lighting will comprise sodium, fluorescent and mercury vapour lamps. Borough Engineer, Municipal Bldgs. Greenfield St.

April 10.—Dublin. Commissioners of Public Works invite tenders for electrical works and supplies required for building in and around the city for one year from May 2. J. Tyrrell, secretary, Office of Public Works, Dublin. Deposit £1.

April 12.—Manchester. Electrical installation at police garage and transport H.Q., St. Joseph's Bldgs., Longsight. City Architect, Town Hall. Deposit £1 1s. (Advertised in this issue.)

April 13.—Golborne U.D.C. Supply and erection of Group A sodium lighting along approx.

¼ mile of the Liverpool-East Lancs. Rd. (A.580) at Lowton. J. B. Hoyle, Engineer and Surveyor, Council Offices, Lowton Nr. Warrington.

April 19.—Manchester. Electrical installation at Newall Green secondary school. City Architect, Town Hall. Deposit £1 1s. (Advertised in this issue.)

No date stated.—Aberdeen. Electrical work in erection of Kaimhill primary school and completion of Inverdee infant school. J. A. O. Allan, Ross and Allan, Architects, 10 Bon-Accord Sq.

No date stated.—Downe T.C. Electrical work in 10 houses at Castlehill. Applications to D. A. McNeill, Town Clerk, Dunblane.

No date stated.—Inverness. Board of Management for Hospitals require supply of electric lamps for year from April 1. Supplies Officer, Craig Dunain Hospital, Inverness.

No date stated.—Midlothian. Electrical work in four houses at Temple. County Architect, 32 Palmerston Pl., Edinburgh 12.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Mar. 26.—Egypt. Supply of 129 km of vulcanised rubber insulated cables, taped, braided, and compounded, single core, for Cairo Electricity and Gas Administration. B.o.T. (Ref. CRE (IB) 55222/51).*

Apr. 9.—Egypt. Supply and delivery of 20 power transformers at 100 kVA and 20 125 kVA. Documents from Chief Inspecting Engineer, Egyptian Govt., 41 Tothill St., S.W.1. Deposit £2 1s. (Advertised in this issue.)

April 16.—Uruguay. Direccion General de Communicaciones (Servicio de Transmissiones) are asking for tenders for various valves and American-type sockets. B.o.T. (Ref. CRE (IB) 55953/51.)*

June 5. — Wellington (N.Z.). Supply of 110 kV switchgear for Waitaki power station for State Hydro-Electric Dept. B.o.T. (Ref. CRE (IB) 54953/51).*

June 12. — Wellington (N.Z.). State Hydro-Electric Dept. requires 15 MVA 400 V switchgear of duplicate busbar indoor metal-clad type with accessories, comprising one 14-panel switchboard, a switch handling truck (if required) and a set of spares. B.o.T. (Ref. CRE (IB) 54954/51).*

CONTRACTS PLACED

Barrow-in-Furness T.C. Lighting and heating installations in 164 houses at Newbarns South, C. A. Eisner, £5,048.

Billingham-on-Tees U.D.C. Street lighting from Sandy Lane to Wolviston along trunk road A.19, Revo Electric Co., £2,937.

Bristol. Installation, erection and maintenance of lighting at Clifton Suspension Bridge, Gough Bros., £1,430.

Colne T.C. Erection of eleven 60 W sodium lamps with concrete columns and all auxiliary equipment, Revo Electric Co., Ltd.

Durham. Electrical work at Lambton Castle Residential College, £2,692, and at New Seaham county school, £1,035, North of England Engineering and Electrical Co.

Finchley. Supply of 312 street lighting fittings and 36 columns, Revo Electric Co., Ltd., £1,087.

Ilford T.C. Installation of lighting in Town Hall, G. R. Stanton and Co., Ltd., £1,200.

Kelso T.C. Addition 136 lamps for street lighting scheme, Kirkpatrick and Sons, £5,645.

Leeds. Cable and joint boxes for Knostrop sewage works, Aberdare Cables Ltd., £1,375; repair and renewal of electric cable at Leighton reservoir, Yorkshire Electricity Board, £1,073; supply of twenty 24 V batteries, Oldham and Sons, Ltd., £1,074.

Morley T.C. Extension of sodium lighting along approx. 720 ft of roadway, General Electric Co., Ltd., £1,933.

North Riding. Third stage of fluorescent lighting in County Hall, Hardisty and Nelson, £1,091.

South Shields. Supply of transformers and switchgear for ore-discharging quay at Tyne Dock, English Electric Co. Ltd., £1,000,000.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Etronic. 693,981. Class 9. Wireless and television instruments. Hale Electric Co., Ltd., Radio Works, Talbot Rd., West Ealing, W.13.

Norcraft. 693,893. Class 7. Machines and machine tools, electric motors, etc. Handcraft Supplies (Northern) Ridley, Place, Newcastle-upon-Tyne.

Nuvox. 693,439. Class 9. Sound recording and reproducing apparatus employing magnetised tape. Christine Bruce Productions Ltd., 59 Sloane St., S.W.1.

Pantha. 692,421. Class 7. Portable electrically-driven tools 692,422. Class 9. Electric blowers and vacuum cleaners,

Your Queries — Answered

"Mycalex" thermostats, makers of? T.E.—Mycalex Co. Ltd., Ashcroft Road, Cirencester. (19618)

Electrically-heated boiling equipment for sugar and glucose, makers of? N.W.B.—Brierley, Collier and Hartley Ltd., Sunridge, Ruden Way, Epsom Downs. (19627)

Domestic ½ lb. coffee grinder, makers of? E.B.—There is no trace of such a machine being made in this country at present, but a representative of Kenwood Electrics Ltd., 151, Oxford St., London W.1, stated that they intend to produce one in the near future as an attachment to their food mixer. (19673)

"Safeways" adaptors, makers of? M. H.—British Mechanical Productions Ltd, 21, Bruton St., W.1. (19635)

"Streamiron" automatic irons, makers of? D.E.—Thermionic Products Ltd., Pratt Walk, S.E.11. (19652)

"Hobourn" oil filled radiator, —makers of ? G.S.P. Hobourn Home Appliances, Ltd., Temple Farm Works, Strood, Rochester, Kent. (19667)

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWER WANTED

Jabez Bate and Co. Ltd., address for service? L.M. (19682)

TRADE MARKS Continued

being articles incorporating fractional-horse power motors. 692,423. Class 11. Electrically operated hair driers and electric fans, being articles incorporating fractional h.p. motors. Leonard Heys Ltd., Faraday House, Henry St., Blackpool.

Pigebesteel. 695,294. Class 9. Asbestos-insulated, stainless-steel sheathed electric conductors or cables. Pirelli-General Cable Works Ltd., 343/345 Euston Rd. N.W.1.

Portogram. 685,584. Class 9. Radio receiving sets, radiogramophones, and sound amplifiers. Portogram Radio Electrical Industries Ltd., Preil Works, St. Rule St., S.W.8.

Seascan, with design. B682,885. Class 9. Marine radar apparatus for navigational purposes. Metropolitan-Vickers Electrical Co., Ltd., 1-3 St. Paul's Churchyard, E.C.4.

Zwix. 693,431. Class 11. Electric fans. A. N. Produets, Halfway House, Vache Lane, Chalfont St. Giles, Bucks.

TRADE NOTES

New factories. The British N.S.F. Co. Ltd., of Ingrow Mills, Keighley, is to open a factory at Liverpool this year.

Burndept Ltd. have completed negotiations with the Board of Trade for taking over another large factory at South Shields.

Clarification. Smart and Brown (Machine Tools) Ltd., of 24/25 Manchester Sq., W.1, and Sabel Works, London Rd., Biggleswade, Beds., announce that they are in no way connected with Smart and Brown (Engineers) Ltd. which has recently been acquired by Thorn Electrical Industries Ltd.

We are also advised by Smart and Brown (Engineers) that no connection exists between themselves and Duralite Lamps, Ltd. From May 1, 1951, lamps of this manufacture will cease to be supplied by Smart and Brown (Engineers), Ltd.

B.E.A.M.A. Contract Price Adjustment Formulae for calculating variations in respect of changes in "Rates of Pay" is based on the rates of pay for adult male labour. Owing to the unusual nature of the National Wage Agreement of November, 1950, an arithmetical addition of 11s. to the current published "Rate of Pay" of 115s. would not result in a realistic figure. In view of this, the only practical way of interpreting the rise is by an *ad hoc* assessment, and an increase of 5s. is the assessment that has been made as a measure of the effects of the agreement. The "Rate of Pay", therefore, for labour in the Contract Price Adjustment Formulae, as from November 13, 1950, and until further notice, is deemed to be 115s., plus 5s., i.e., 120s. If experience of the working of the National Wage Agreement makes a different assessment necessary, a further announcement will be made.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Monday night)

	£ s. d.	New York price
COPPER, electrolytic	202 0 0	£196 0 0
Delivered in 2nd and 3rd month after order	215 10 0	—
Delivered in 4th, 5th and 6th month after order	217 0 0	—
LEAD, good soft pig (foreign)	136 0 0	136 0 0
" "English" quality	137 10 0	
Delivered in 2nd and 3rd month after order, plus	7 0 0	
TIN (99-99.75%) (Cash)	1260-1270	—
" (3 months)	1155-1160	—
ALUMINIUM, commercial purity (del.)	124 0 0	—
ZINC	151 0 0	140 0 0
ARMOURING:		
Galv Steel Wire (0.104 in.)	46 10 0	—
Mild Steel Tape (0.04 in.)	26 10 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Ernest B. Davis Ltd., electrical contractors. Creditors have appointed the following liquidators: Silas O. Henry of Parkin S. Booth and Co., 5 Rumford Place, Liverpool, and Lewis Aspinall Pardey of Pardey and Walsh, 65 Gerard St., Ashton-in-Makerfield.

Frederic Moyle Ltd., radio, electrical and television contractors. A. W. Hunter of 185-188 High Holborn, W.C.1, has been appointed liquidator.

Solar Electric Co., Ltd. Resolution for voluntary winding-up passed at meeting on Feb. 28. Victor A. D. Kent, Incorporated Accountant, of J. Hulbert Grove and Co., 9 Cavendish Sq., W.1, was appointed liquidator.

Voluntary Liquidation

Refrigeration Enterprise Co., Ltd., refrigeration engineers of Sheffield. At a meeting of creditors a statement of affairs showed liabilities amounting to £2,789 16s. 3d., against net assets of £1,499 17s. 8d., thus leaving a deficiency as regards creditors of £1,289 18s. 7d. The issued share capital of the company was put down at £1,220 and, so far as the shareholders were concerned, there was a total deficiency of £2,509 18s. 7d. Shareholders had already met and passed resolution for voluntary liquidation. Resolution was confirmed and Mr. P. Cardwell, of Poppleton and Appleby, C.A., 93 Queen St., Sheffield, was appointed liquidator with committee of inspection.

BANKRUPTCY ACTS

Order on Application for Discharge

London. Les L. O'Connor, electrical and radio contractor, trading as "Paragon Electrical" at 27 Wellington Sq., S.W.3. Discharge suspended for two years and six months and that he be discharged as from Aug. 9, 1953.

Dividend

Bournemouth. Aubrey S. F. Carpenter, trading as "Stourvale Radio Stores," Christchurch. Supplemental dividend of 5s. 6½d. in £ payable at Official Receiver's Office, 16 Westwood Rd., Southampton, on April 6.

Intended Dividend

Torquay. Stanley H. E. Ledbrooke, radio engineer, trading as "Devon Electronics," at 14 Grove Av., Teignmouth. Last day for receiving proofs, March 28. Trustee is Cyril Thos. Newman, Official Receiver, 3 Central Bldgs., Matthew Parker St., S.W.1.

First Meeting

Ipswich. Jack Cooper, mechanical and electrical engineer, trading at Market Place, Orford. Meeting at 13a Gt. Colman St., Ipswich, on Mar. 30 at 2.30 p.m., and public examination at Shire Hall, St. Helen's, Ipswich, on May 3 at 10.30 p.m.

BUSINESS PROSPECTS

HOME

Abergavenny (Mon.) R.D.C. Work to proceed on conversion of present offices in Monk St. and erection of council chamber.

Arundel T.C. Erection of 18 houses. Council's Architect, T. Greenfield, Newstead, Midhurst, Sussex.

Belfast. Erection of 174 houses on Donegal Pk. Ave. estate. Offices of Housing Architect, 94 Chichester St.

Bellingham (Northumb.) R.D.C. £2,500 is to be spent on conversion of premises above council offices into new council chamber and committee rooms.

Birmingham. Erection of 73 houses and bungalows at Bartley Green. Herbert J. Manzoni, City Engineer and Surveyor, Civic Centre.

Bridlington T.C. Erection of two blocks of 12 flats on the West Hill estate. Borough Engineer, Town Hall.

Bury T.C. Erection of Fairfield county primary school in Rochdale Old Rd. Borough Engineer and Surveyor, Town Hall.

Ceanannus Mor U.D.C. Construction of 54 houses in Moynalty Rd. Quantity Surveyor, Fergal Coghlan, 133 Lower Baggot St., Dublin.

Darlington T.C. Erection of 46 houses at Springfield and 30 at Lanethorpe Crescent. Council has received sanction to borrow £50,600 for erection of 34 houses and 6 bungalows at Haughton North and South, £46,472 for 40 houses at Haughton South. Also seeking sanction to borrow £58,772 for erection of 36 flats and 14 houses at Haughton South. Borough Architect is E. A. Tombohm, Central Buildings.

Doncaster T.C. Erection of 28 houses in blocks of four on the Cantley estate. Estates Surveyor, 15 South Parade.

Dundalk (Co. Louth). Extension and alterations to St. Malachy's girls and infant school. Nolan and Quinlan, Architects, 23 Ely Place, Dublin.

Edinburgh. City Council has approved the erection of an office block in George St. for Sun Insurance Office, Ltd.

Ellesmere Port (Cheshire) U.D.C. Permission has been received to build a public hall. Estimated cost is £100,000.

Finchley. It is proposed to build 28 flats in Hendon Lane, and six dwellings in Abingdon Rd. and Long Lane.

Guisborough (Yorks). Newcastle-on-Tyne Regional Hospital Board are to invite tenders for alterations to the General Hospital. Chief architect to the Board is P. H. Knighton.

Hillsborough (N. Ireland) R.D.C. Erection of 40 houses at Saintfield and 12 at Ballykeel-Artifinney. Gamble and Maxwell, Architects, 5 University Terrace, Belfast.

Hull. Erection of East Hull Congregational Church in James Reckitt Ave. Architect is A. Percy Taylor, 59 Chapel St., Belper.

Huntingdon. Erection of county primary school at Stanground, near Peterborough, for C.C. S. J. Hands, County Architect, County Bldgs., Huntingdon.

Ilford T.C. Seventy-two flats are to be built in Billet Road.

Keighley T.C. Erection of 78 houses on Bracken Bank estate.

Kent. C.C. recommended to approve improvements to electrical installation at Chatham House county grammar school. Estimated cost is £3,500. It is proposed to build old persons' home off Brunswick Rd., Bexley.

Langport (Som.) R.D.C. Plans approved for erection of 20 houses.

Liverpool. Construction of 18 houses at Sefton Park, 10 at Toxteth, 25 at Kirkdale and 6 at Clubmoor. City Architect and Director of Housing, Blackburn Chamber, Dale St., Kingsway, Liverpool 2.

Macduff T.C. Approval has been received to build 20 houses at estimated cost of £37,500.

Manchester. Council recommended to apply for sanction to borrow £35,000 for erection of 27 houses at Wythenshawe.

Morecambe T.C. Revised layout approved for Trumacar Lane estate including 24 houses, shops and public buildings. Council to apply for sanction to borrow £10,800 for 12 flats in Warren Grove. Also approved erection of 20 houses.

Newcastle-under-Lyme (Staffs) T.C. Two hundred houses are to be erected at Clayton.

Newhaven (Sussex). S.E. Metropolitan Regional Hospital Board has approved expenditure of £1,500 for installation of electric lighting and power at Newhaven I.D. Hospital.

Pewsey (Wilts). W.D. is to build 70 houses at Hedge End and 60 at Ludgers Hall.

Redditch U.D.C. Construction of 20 shops and maisonettes on the Batchley estate. Edward Buckley, Engineer and Surveyor, Council House, Redditch, Worcs.

Rotherham R.D.C. Erection of 40 houses at Thrybergh. Council's Architects, Taylor, Knight and Co., "Brooksmoor House," Grove Rd., Moorgate.

Salford. Alterations and additions to public library in King St. City Engineer's Office, Town Hall.

Sevenoaks R.D.C. Erection of 16 houses at Edenbridge. Engineer and Surveyor, Town Hall, Sevenoaks.

South Shields T.C. Licences have been allocated to seven local builders for the erection of 50 houses.

Stanley (Durham) U.D.C. Layout plans approved for erection of 73 houses at Shield Row.

Stoke Newington. Plans approved for erection of 34 houses on various sites in the borough.

Stourport - on - Severn U.D.C. Construction of 35 houses on Walshes Farm estate. Architects, Godwin, Clist and Greenway, Bank Bldgs., Kidderminster.

Sutton and Cheam T.C. Bills of quantities being prepared for erection of 21 old persons' dwellings.

Wallasey. Cadbury Bros., Ltd., are negotiating with T.C. for the erection of a factory.

Walsall T.C. Erection of 36 flats in three blocks on the Forest estate. Sanders and Proffitt, Architects, 145 Lichfield St.

Walthamstow T.C. Erection of 24 flats in Falmouth Ave. Council recommended to appoint C. E. Ball and Partners, Dilke House, Malet St., as quantity surveyors.

West Hartlepool. A pathological department is to be built at General Hospital for the Newcastle-on-Tyne Regional Hospital Board. Contract to be let shortly. Board's architect is P. H. Knighton.

Whittlesey U.D.C. Council to build 80 blocks of four flats on Victory Ave. estate. Plans by Ruddle and Wilkinson of Peterborough.

Widnes T.C. Erection of 76 dwellings on Crow Wood estate. H. Nevile Player, Borough Architect, Brendan House, Widnes Rd.

Wigan T.C. Application to be made for sanction to borrow £172,000 for first instalment of the proposed branch college of further education.

Worcestershire. Erection of a day nursery at Redditch. L. C. Wakeman and Partners, Quantity Surveyors, 126 Hagley Rd., Edgbaston, Birmingham 16.

OVERSEAS

U.S.A. The West Coast Engine and Equipment Co., 915 Ashby Ave., Berkeley, California, is enquiring for quotations from U.K. manufacturers of a.c. generators from 2 kW to 200 kW in size and have stated a preference for self-regulating type. Interested firms should contact the company direct.

Belgium. Societe Nationale des Chemins de Fer Vicinaux, 14 rue de la Science, Brussels, want to purchase from the U.K. d.c. meters 650 to 700 V and 600 to 200 amperes. These are required for substations supplying local tramways. Firms are asked to communicate direct quoting reference TM/OS/347, 11, St. Joris-Winge and Heverlee.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London, W.C.2.

J. Sanger and Son, Ltd., 9 Cobourg St., Plymouth. Electrical wholesale factors, etc. Cap.: £15,000. Dirs.: J. Sanger and H. Sanger.

Northern Washer Service, Ltd., 16 King Charles St., Leeds. Repairers, maintainers and servicers of washing machines, etc. Cap.: £100. Dirs.: H. Brown, P. Gibson, A. L. Hopton and Florence Kitchen.

Phillips and Dart (Worthing), Ltd., 32 Warwick St., Worthing, Sussex. Manufacturers of and dealers in radio, electrical and television apparatus, etc. Cap.: £1,000. Dirs.: F. Dart, Mrs. L. W. Dart and R. V. Dart.

Harold Feldman, Ltd., Winnie Terr., Whitehall Rd., Leeds. To take over business of a manufacturer, merchant and agent in respect of domestic woodwork, radio and electrical goods carried on at 19-23 Newcastle Pl., Town St., Bramley, Leeds, by Harold Feldman, and at Winnie Terr., Whitehall Rd., Leeds. Cap.: £500. Dir.: H. Feldman.

Peter James Contractors (Southern), Ltd., 262 Northolt Rd., South Harrow, Mddx. To construct, erect and carry on railways, tramways, gas, electricity and water works, roads and bridges; and to carry on business of civil, mechanical and general engineers, etc. Cap.: £3,000. Dirs.: P. N. Brown and Mrs. R. M. Brown.

Electro-Mechanical Engravers, Ltd., 37 De Vere Gdns., W.8. Designers, manufacturers and producers of electro-mechanical engraving machines, etc. Cap.: £100. Dirs.: to be appointed by subs. Subs.: E. A. Phillips, 86 Dukes Av., Muswell Hill, N.10, and C. W. Swift, 135a Friern Barnet Rd., New Southgate, N.11.

A. R. Parsons and Co., Ltd., 275 Main Rd., London Colney, Herts. Engineering in all its branches, machinists, electricians, etc. Cap.: £5,000. Dirs.: to be appointed by subs. Subs.: W. H. Brown, Lamsey Farm, Little Gaddesden, Herts, and E. Shatter, 11 Avenue Park Rd., West Norwood, S.E.27.

T. and G. Small Parts Supplies, Ltd., 84 Hatton Gdn., E.C.1. Scientific, industrial and general engineers, manufacturers of electrical equipment, spare parts and components for motor car, aeroplane and marine engines, etc. Cap.: £100. Dirs.: P. M. G. Thorpe and P. Goldesgeyme.

Austin Kyme, Ltd. Manufacturers of and dealers in wireless apparatus, cabinets, loud speakers, etc. Cap.: £5,000. Dirs.: A. Kyme, R. H. Armstrong and G. E. A. Manser.

Silverdale Radio and Television Service, Ltd., 15 Silverdale Parade, Eastern Av., Ilford. Cap.: £500. Dirs.: R. A. E. Williams and Mrs. J. Williams.

Excel Sound Services, Ltd. To acquire business of mechanical, electrical and sound engineers carried on at 49 Bradford Rd., Shipley, by Excel Sound Services, etc. Cap.: £10,000. Dirs.: F. Thistlethwaite, B. D. Watmough and W. G. Hopkinson.

Filtrite, Ltd. Manufacturers of and dealers in urns, electric teapots, electric coffee pots, under the name of "Filtrite," and domestic kitchen equipment, etc. Cap.: £25,000. Dirs.: M. Broad, G. Heilpern and H. M. Williams.

MEETINGS TO NOTE

THURSDAY, MAR. 22

BRITISH INSTN. OF RADIO ENGRS. (Scottish Section)—"Magnetic Amplifiers," H. M. Gale. Instn. of Engrs. and Shipbuilders, Glasgow, 7 p.m.

TUESDAY, MARCH 27

SOC. OF INSTRUMENT TECHNOLOGY. —"Magnetic Amplifiers." D. A. J. Maddock. Manson Hse., Portland Place, W.1, 6.30 p.m.

WEDNESDAY, MARCH 28

I.E.E. (N.W. Supply Group).—Discussion on Section III (Generation) of Report of Electricity Team of Anglo-American Council on Productivity. Engineers' Club, Albert Sq., Manchester, 6.15 p.m.

I.E.E. (Southern Centre).—"Planning of an Electricity Board's Distribution System." G. O. McLean. Tech. College, Brighton, 6.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (W. Midlands Section).—"Engineering Aspects of Industrial Electronic Equipment." R. J. F. Howard. Tech. College, Wolverhampton, 7 p.m.

THURSDAY, MARCH 29

I.E.E. (Western Centre).—Faraday lecture on "Lamps and Lighting—a Record of Industrial Research." L. J. Davies. The Guildhall, Swansea, 6.30 p.m.

I.E.E. (S.W. sub-centre).—"Evolution of the Lighting Art." J. W. T. Walsh. Grand Hotel, Plymouth, 3 p.m.

PURCHASING OFFICERS ASSOC. (Yorks Branch).—"Manufacture of Super-Tension Cables." F. W. H. Shaw. Gt. Northern Hotel, Leeds, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (London).—"Nuclear Scintillation Counters." J. B. Birks. School of Hygiene and Tropical Medicine, Keppel St., W.C.1, 6.30 p.m.

I.E.S. (Nottingham Centre).—"Lighting of Lace Furnishing Machines." D. I. Griggs and F. Jamieson. Gas Showrooms, Parliament St., 5.30 p.m.

HUDDERSFIELD ENGRNG. SOC.—"Overhead Transmissions." Dr. J. McCombe of Y.E.B. Elect. Service Centre, Market St., Huddersfield, 7.30 p.m.

ELECTRICAL POWER ENGRS. ASSOC. —"The Heat Pump." Miss M. V. Griffiths of Elect. Research Assoc. M.E.B. Showrooms, Darlington St., Wolverhampton, 7 p.m.

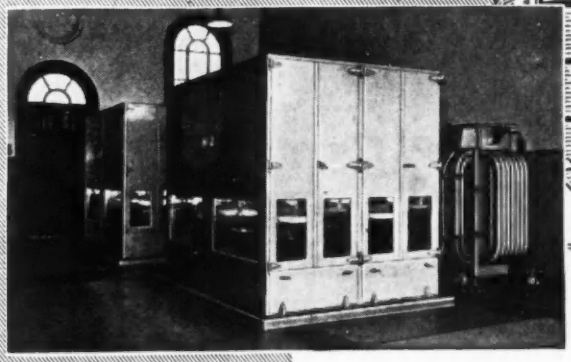
FRIDAY, MARCH 30

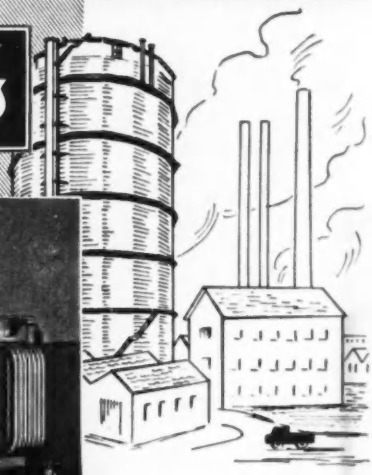
I.E.S. (Birmingham Centre).—"Interesting Applications of Photometry and Colorimetry." G. F. Lothian. Imperial Hotel, Temple St., 6 p.m.

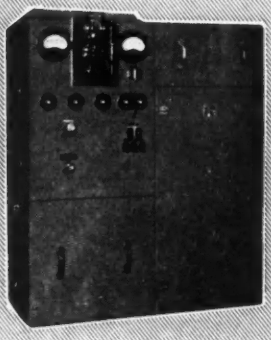
I.E.E. (N.E. Students Section).—"Reduction of Reactive Energy Losses by Means of Capacitors." G. P. Cundall. King's College, Newcastle, 6.30 p.m.

Converting A.C. to D.C.

Hewittic Rectifiers







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The problem of providing a D.C. supply—for the operation of variable speed D.C. drives, electrolytic plant, electric locomotives and trucks, cranes, hoists, lifting magnets, magnetic clutches and separating plant, for small scale or bulk charging of batteries for electric vehicles, etc.—for almost every application where D.C. is required—is most effectively solved by installation of a HEWITTIC Rectifier, the simplest, most reliable converting plant made.

This equipment operates at high efficiency with corresponding low running costs, requires negligible maintenance, *operates completely unattended*, is easily installed in existing buildings and awkward sites without special foundations or the need for crane facilities.

The illustrations show:—

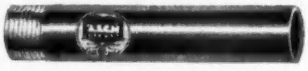
Above: *A 500 kW Hewittic rectifier installation supplying D.C. motor driven plant at the Portslade Gasworks*

Left: *35 kW Hewittic rectifier operating a rubber calender: providing an extremely wide range of speed variation by means of grid control*

HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., WALTON-ON-THAMES, SURREY

Telephone: Walton-on-Thames 760 (8 lines) *Telegrams: "Electric," Walton-on-Thames*

"It's no trouble at all!"



Screwed & Socketed Gas Thread

Screwed & Socketed Conduit Thread

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How often one hears that remark but how *true* it is when you are working with Metallic Conduit Tube and Fittings. For quality and consistent accuracy—

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THE METALLIC SEAMLESS TUBE Co. Ltd., Ludgate Hill, BIRMINGHAM 3. Tel. CEN 7167
Also at London, Newcastle-on-Tyne, Leeds, Swansea and Glasgow

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

EGYPTIAN GOVERNMENT

TENDERS are called for by the Director General, Cairo Electricity and Gas Administration, for the supply and delivery into Stores, Cairo, of POWER TRANSFORMERS (20-100 kVa and 20-125 kVa).

Tenders should be submitted to: The Director General, Cairo Electricity and Gas Administration, 53 Fouad El Awal Street, Cairo, Egypt, not later than noon on April 9, 1951.

Copies of the necessary conditions of tender, specification etc., can be obtained on application to the Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, London S.W.1, against remittance of £2 1s. per set, which sum must be pre-paid and is not returnable. Copies of these documents are also available for scrutiny at the above address. Cheques must be endorsed permitting transfer to an Egyptian Government account.

Ref. No. 44/Elect. and Gas 3/2/139 must be quoted in all correspondence. (K 234)

APPOINTMENTS VACANT

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for an appointment as SECOND ASSISTANT ENGINEER (Protection) in the Technical Department of the Yorkshire Division.

Applicants should be Corporate Members or Graduates of the Institution of Electrical Engineers and should have had experience in the manufacture, testing and commissioning of the electrical equipment used in Generating stations and on main transmission systems and of automatic protective gear technique.

The commencing salary will be within Grade 2 of Schedule "C" of the National Joint Board Agreement i.e., £752 per annum to £884 per annum, according to qualifications and experience, rising ultimately to a maximum of £966 per annum.

The appointment will be subject to the provisions of the Authority's Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Yorkshire Division, British Electricity House, St. Mary's Road, Leeds 7, to whom completed forms must be returned within 14 days of the appearance of this advertisement. Envelopes to be endorsed "Second Assistant Engineer (Protection)."

G. A. VOWLES,
Divisional Controller.
(K 205)

KENT COUNTY COUNCIL

APPLICATIONS are invited for appointment in t e Buildings Department of an ENGINEERING ASSISTANT (Electrical) at a salary in A.P.T. Grades I-III (£390-£495).

Applicants must be capable draughtsmen with practical experience in electrical installation work and should preferably be graduate members of the Institution of Electrical Engineers.

The commencing grade and salary will be dependent upon qualifications and experience. The post is superannuable and the successful candidate will be required to undergo a medical examination.

Applications, on forms obtainable from the County Architect, Springfield, Maidstone, must be delivered to him within 14 days of the appearance of this advertisement.

W. L. PLATTS,
Clerk of the County Council.

County Hall, Maidstone.
March 14, 1951. (K 231)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the Technical Department at Divisional Headquarters, Birmingham. The salary will be in accordance with Schedule "C," Grade 8, of the National Joint Board Agreement, £437 to £569 per annum, commencing at £437 per annum.

Applicants should possess a university Degree in Electrical Engineering, or be Graduates or Corporate Members of the Institution of Electrical Engineers, and should have had some practical experience in the electrical manufacturing or supply industry. Experience in commissioning and maintenance testing of generating station and sub-station protective gear will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms which may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than April 7, 1951.

F. W. LAWTON,
Divisional Controller.
(K 212)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Clyde Sub-Area

APPOINTMENT OF SENIOR ASSISTANT ENGINEER

APPLICATIONS are invited for the appointment of Senior Assistant Engineer at Clyde Sub-Area Headquarters, 206 St. Vincent Street, Glasgow C.2.

The salary for the post will be in accordance with the revised National Joint Board Agreement, Class "J," Grade 4, i.e. £939-£983 per annum.

Applicants should possess a Degree in Electrical Engineering or equivalent qualification and have experience of the design, construction and operation of distribution systems together with specialised knowledge of metering practice and testing, protective gear application and testing, supervisory and remote control, communications and electronics.

The successful applicant will require to satisfy the Board's medical adviser and contribute to a superannuation scheme.

Applications, stating age, education, qualifications, experience, present position and salary, should be received by The Manager, The South West Scotland Electricity Board, Clyde Sub-Area, 206 St. Vincent Street, Glasgow C.2, not later than 14 days after the appearance of this notice. (K 214)

BRITISH ELECTRICITY AUTHORITY

Chief Engineer's Department—London

SENIOR DRAUGHTSMEN
DRAUGHTSMEN

APPLICATIONS are invited for the following vacancies in the drawing office at headquarters in London.

Senior Draughtsmen and Draughtsmen. Candidates should be experienced in one of the following:—(a) Generating station layout; (b) Layout of 132 kV substations; (c) Preparation of schematic and protection diagrams, preferably 132 kV; (d) Reinforced concrete structures and light concrete foundations.

The salaries will be in accordance with age and experience within the following provisional salary ranges:—Senior Draughtsmen—Grade "A," £500 to £600 p.a.; Grade "B", £600 to £700 p.a. (vacancies in (a) above only). Draughtsmen—£312 p.a. at age 21, £468 p.a. at 25, rising to a maximum of £500 p.a., including London allowance.

All the appointments are superannuable.

Application forms may be obtained from the Secretary's Office (Establishments), Application Section, British Electricity Authority, British Electricity House, Great Portland Street, London W.1, and should be completed and returned to D. Moffat, Director of Establishments, not later than April 10, 1951.

Please quote Reference AE/145. (K 215)

SINGAPORE MUNICIPALITY

Electricity Department

CHARGE ENGINEERS, permanent staff, required for shift duties in the Singapore power station. Present capacity 37,000 kWs, with proposed extensions to 87,000 kWs.

Experience of extra high tension, 3-phase generation in a modern high-pressure steam power station required. Appointment subject to medical examination.

Basic salary scale $440 to $870 per month. Starting point according to qualifications and experience. Graduated scale of Allowances, e.g., present Allowances on $590 p.m. basic salary amount to: Expatriation $110 p.m. plus Cost of Living $198 p.m. for single man or $256·50 p.m. for married man, or $334·50 p.m. for married man with family. One Straits Dollar equals 2s. 4d. Thus a married man with family on basic salary of $590 would draw equivalent of £1,448 sterling per annum.

Quarters with heavy furniture provided at 8% of salary or housing allowance in lieu. Initial engagement on three years' agreement. Eight months' leave after four years' service. Free medical attention. Passages paid, including family (children under 17). Compulsory Provident Fund Contribution 7½% of salary and Municipal Commissioners donate 7½% for first 10 years, rising to 20% after 20 years' service.

Applications in duplicate, with full personal and technical information and copies of three testimonials, to Messrs. Peirce & Williams (Agents to the Municipal Commissioners), 1 Victoria Street, London S.W.1. (K 133)

METROPOLITAN WATER BOARD

APPOINTMENT OF ENGINEERING ASSISTANT (ELECTRICAL)

APPLICATIONS are invited from Chartered Electrical Engineers or from those who have passed or are exempted from passing sections A and B of the Associate Membership examination of the Institution of Electrical Engineers, for appointment as Engineering Assistant.

Applicants, who should not be more than 40 years of age, should preferably have served a trade apprenticeship and have had subsequent practical experience on heavy power installation work, h.t. and l.t.

Salary limits of £420 to £630 per annum, subject to progression beyond £555 per annum being restricted to corporate members of the Institution. Commencing salary according to qualifications, age and experience.

Housing accommodation available in good neighbourhood, if required.

Particulars of the appointment and a form of application may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, quoting reference (ET).

W. S. CHEVALIER,
Clerk of the Board.

Offices of the Board, New River Head,
Rosebery Avenue,
London E.C.1. (K 184)

COUNTY BOROUGH OF HALIFAX

Borough Engineer's Department

APPOINTMENT OF ELECTRICAL ENGINEER

APPLICATIONS are invited for the above appointment at a salary in accordance with Grade VI A.P.T. (£595 to £660). Candidates should be suitably qualified and should be capable draughtsmen with experience in the preparation of schemes and specifications for electrical installation work.

The appointment will be subject to the conditions of service adopted by the Corporation and to the Local Government Superannuation Act, 1937.

The successful candidate will be required to pass a medical examination.

Candidates must disclose whether, to their knowledge, they are related to any member of, or the holder of any senior office under, the Council.

Applications, stating age qualifications, present position, salary and experience, accompanied by copies of three recent testimonials, should be appropriately endorsed and delivered to the undersigned not later than Saturday, April 7, 1951.

RICHARD DE Z. HALL,
Town Clerk.

Town Hall, Halifax.
March 10, 1951. (K 208)

BRITISH ELECTRICITY AUTHORITY

Croydon 'B' Power Station

JUNIOR ENGINEERS (control). Experience in operation of e.h.t. switchgear and parallel running of alternators essential. Higher National Certificate preferable. N.J.B. conditions of service and salary Class "J," Grade 18, commencing at £375 per annum, rising to a maximum of £478 per annum plus London allowance. Application forms, obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-upon-Thames, to be returned by March 31, 1951. (K 206)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the Generation Construction Department at Wolverhampton. The salary range will be in accordance with Schedule "C," Grade 8 of the National Joint Board Agreement, £437 to £569 per annum, commencing at £437 per annum.

Candidates should hold Higher National Certificate in mechanical engineering and should have had experience in (1) the design and installation of mechanical equipment for power stations or industrial works, and/or (2) a knowledge of boiler and turbine design in the Contracts Department of a large engineering works.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms which may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than April 7, 1951.

F. W. LAWTON,
Divisional Controller.
(K 213)

UNIVERSITY OF CAPE TOWN

APPLICATIONS are invited for:—

(a) SENIOR LECTURESHIP IN ELECTRICAL ENGINEERING

(b) LECTURESHIP IN ELECTRICAL ENGINEERING

The salary scale for a Senior Lecturer is £800 by £40 to £1,000 per annum and for a Lecturer £550 by £25 to £800 per annum. There is also a temporary cost-of-living allowance, at present £208 per annum for a married man and £83 per annum for a single man.

In the case of the Senior Lectureship, experience in electronics will be a recommendation; and in the case of the Lectureship, experience in heavy electrical machinery will be a recommendation.

Applications (with copies of testimonials) must be submitted in triplicate, and must give age, qualifications, teaching experience and practical or research work. Applicants should give the names of two referees whom the University may consult. Two copies of the application must reach the Secretary of the Association of Universities of the British Commonwealth, 5 Gordon Square, London W.C.1 (from whom a memorandum giving the general conditions of appointment is obtainable), by May 30, 1951, and the other copy sent direct to the Registrar, University of Cape Town, Private Bag, Rondebosch, South Africa, by the same date. (K 220)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER, Class "AX/BX" (8), in the department of the Generation Engineer (Construction) at Portobello, commencing salary £437 per annum.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and the appointment will be superannuable under the terms and conditions of the Authority's Superannuation Scheme.

Applicants should possess a Higher National Certificate in Electrical Engineering or its equivalent and have experience in the layout and design of Generating Station plant.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, Portobello, Midlothian, not later than March 30, 1951.

J. F. FIELD,
Divisional Controller.
(K 204)

CROWN AGENTS FOR THE COLONIES

ASSISTANT ELECTRICAL ENGINEER required by the Singapore Harbour Board for 3 years in the first instance. Salary payable in local currency equivalent, present exchange rate, to £753, rising to £1,072 a year, including expatriation pay and Singapore allowance. Cost-of-living allowance equivalent to between £252 and £462 a year according to salary and dependants. Free passages and quarters. Liberal leave on full salary. Candidates (25 to 35 years of age) should have received a sound technical training in electrical engineering, with practical experience in electronics and its applications, and in addition should have had practical experience in either the erection and maintenance of sub-station and high and low tension overhead and underground a.c. distribution systems, or in plant repair work, including the rewinding and testing of all types of a.c. and d.c. dynamo electric machinery.—Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London S.W.1, quoting M.28489.B on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (K 207)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Generation Construction Department at Divisional Headquarters:

DRAUGHTSMEN (MECHANICAL)

The commencing salary will be within the range of £385 to £636 per annum, according to age and experience.

Applicants should be in possession of the Higher National Certificate or equivalent, and preferably have served a recognised apprenticeship course. They should be familiar with one or more of the following:

Generating station lay-out and design, coal handling plant, ash and dust-handling system and pipework systems.

The salary is provisional and will be subject to negotiation through the medium of the appropriate negotiating body.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, experience and present position, should be sent in envelopes endorsed "Draughtsmen (Mechanical)," to arrive not later than March 30, 1951, to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (K 193)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in No. 4/5 Sub Area:—

(1) THIRD ASSISTANT ENGINEER (Constructions based on Sub-Area Headquarters, Wrexham, North Wales. Salary £571 to £597 per annum, Grade 10, Classification "H." National Joint Board Agreement.

(2) COMMERCIAL ASSISTANT (Male), Wrexham District. Salary £550 to £560 per annum, Grade 8, Classification "E." National Joint Board Agreement.

Applicants for post (1) should have had experience in the construction of indoor and outdoor main and distribution sub-stations, and the control of all labour engaged thereon. They should also have the technical knowledge to enable them to check and test all ancillary gear. The duties of the post will include the supervision and giving of assistance to civil engineering contractors, liaison with the architect where necessary, and the acceptance and care of plant and materials on site.

Applicants for post (2) should have had a sound engineering training, and experience in cash receipt, banking, and hire-purchase schemes. The duties of the post will be of a general commercial nature, and will include the organisation of the Shotton Service Centre and the preparation of estimates and specifications for electrical installation and contracting work.

Both appointments are superannuable and subject to medical examination.

Applications, on forms obtainable from the Manager, No. 4/5 Sub-Area, Electricity House, Rhostyllen, Wrexham, Denbighshire, should be completed and returned so as to be received not later than April 5, 1951.

JAMES RANKIN,
Secretary.
(K 230)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointments of two GENERAL ASSISTANT ENGINEERS in the Transmission Department. Salary N.J.B., Class "AX.CX," Grade 8: £437/£568-£592/£604 per annum. One appointment will be based on Divisional Headquarters (*a*), and the other at Warrington (*b*).

For (*a*) candidates should have the Higher National Certificate or similar qualifications and are required to carry out overhead line surveys, prepare profiles and peg out tower positions. Preference will be given to those with experience and training in Civil and Structural Engineering.

For (*b*) candidates should have the Higher National Certificate or similar qualifications and must have had experience in the maintenance and operation of 132 kV switchgear, transformers, overhead lines and cables.

The appointments will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme, and may be subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Monday, April 9, 1951.

A. R. COOPER,
Divisional Controller.
(K 236)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are now invited for the following appointments at the Bromborough new Power Station.

(a) MAINTENANCE ENGINEER (Electrical). Salary Class "H," Grade 6, £751 to £783 per annum.

(b) MAINTENANCE ENGINEER (Mechanical). Salary Class "H," Grade 6, £751 to £783 per annum.

(c) JUNIOR ENGINEERS (Turbine House). Salary Class "H," Grade 16, £393 to £407 per annum.

(d) JUNIOR ENGINEERS (Control Room). Salary Class "H," Grade 16, £393 to £407 per annum.

(e) JUNIOR ENGINEERS (Boiler House). Salary Class "H," Grade 16, £393 to £407 per annum.

(f) JUNIOR ENGINEER (Electrical Maintenance). Salary Class "H," Grade 16, £393 to £407 per annum.

For (a) candidates should be Associate Members of the Institution of Electrical Engineers or possess equivalent technical qualifications and must have had a wide experience in the maintenance of modern power station electrical plant.

For (b) candidates should be Associate Members of the Institution of Mechanical Engineers or possess equivalent technical qualifications and must have had a wide experience in the maintenance of modern power station mechanical plant.

For (c), (d), (e) and (f) candidates must have had a good general education and thorough training in engineering. The possession of a Higher National Certificate in electrical or mechanical engineering or equivalent qualifications would be an advantage.

All appointments will be superannuable under the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Friday, April 6, 1951.

A. R. COOPER,
Divisional Controller.
(K 237)

SOUTH WESTERN ELECTRICITY BOARD

Bristol Sub-Area

APPLICATIONS are invited from suitably qualified and experienced persons for the following position in the Bath District (offices at Bath) of the Bristol Sub-Area:—

SECOND ASSISTANT DISTRICT ENGINEER
(Operation and Maintenance)

Commencing salary £579 p.a. (Class "E", Grade 7, N.J.B. Schedule).

Applicants should be thoroughly familiar with the operation and maintenance of urban and rural supply networks up to 11 kV underground and 11 and 33 kV overhead, including sub-station equipment, protective gear and fault location. They should also be conversant with safety regulations and be accustomed to the control of men.

The successful candidate will be required to undertake standby duty.

Corporate or Graduate Membership of the Institution of Electrical Engineers or the possession of the Higher National Certificate in Electrical Engineering will be an added qualification.

Applications, stating present position and salary, qualifications and experience, should reach the District Manager (Bath), South Western Electricity Board, The Old Bridge, Bath, Som., by not later than April 2, 1951.
(K 239)

SOUTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SUB-AREA TRANSPORT OFFICER

APPLICATIONS are invited from persons with the necessary qualifications and experience for the position of Transport Officer in the Board's Cornwall Sub-Area with headquarters at Pool (near Redruth).

The duties will include inter alia: responsibility to the Sub-Area Engineer for operation, maintenance and repair of all vehicles; direction of garage and repair shop work; the supply and store of spare parts; transport returns and compliance with statutory transport regulations.

Applicants should have held a responsible position and have had considerable experience in the electricity supply and/or motor industry; have studied mechanical or automobile engineering; be familiar with statutory, licensing and police regulations. Administrative experience is desirable.

The commencing salary will be £651 per annum in accordance with Class "G", Grade 7 of the N.J.B. Agreement for the Electricity Supply Industry.

Detailed applications, including age, qualifications, experience, present appointment and salary, should be submitted to the Sub-Area Manager, South Western Electricity Board, Pool, Redruth, Cornwall, within ten days. (K 243)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

LONDON ELECTRICITY BOARD

SUPERVISOR (APPARATUS RECONDITIONING)

APPLICATIONS are invited for the above position in the Sub-Area Commercial Department, to take charge of the Central Apparatus Reconditioning Workshop for the Sub-Area to be situated in Longford Street, St. Pancras, London N.W.1.

Applicants should have a sound technical training with a wide practical experience of testing, reconditioning, repairing and assembling all types of electrical appliances and components; and should also be capable of planning, organising and controlling a modern reconditioning workshop. It is also essential that they should be experienced in the control of labour.

Pending grading of the post under the national agreement of the appropriate negotiating body, the provisional salary will be fixed according to qualifications and experience, up to a maximum of £600 per annum inclusive.

Application forms, obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed by April 5, 1951. Please enclose addressed envelope and quote Ref.: EST/V/1167/T, on envelope and all correspondence. (K 241)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following post LADY DEMONSTRATOR, Greenford District of No. 1 (Southall) Sub-Area. Salary N.J.C. Grade 1 (£310-£390 per annum, plus London Weighting). N.J.C. conditions of service.

Qualifications will include possession of a recognised domestic science diploma and/or E.A.W. Certificate. Experience in conducting demonstrations of cooking and domestic appliances essential.

The successful candidate for the above appointment will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill Lane, Southall, Middlesex, and returned to him not later than 14 days after the appearance of this notice. F. W. KEMPTON,
Secretary.
(K 233)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are now invited for the following appointments at the Bromborough new Power Station.

(a) OPERATION and EFFICIENCY ENGINEER. Salary Class "H," Grade 5. £801 to £839 per annum.
(b) ASSISTANT MAINTENANCE ENGINEER (Electrical). Salary Class "H," Grade 8. £644 to £672 per annum.
(c) ASSISTANT MAINTENANCE ENGINEER (Mechanical). Salary Class "H." Grade 8. £644 to £672 per annum.
(d) ASSISTANT ENGINEERS (Turbine House). Salary Class "H," Grade 10. £571 to £597 per annum.
(e) TRAFFIC ASSISTANT. Salary Class "H," Grade 12. £498 to £518 per annum.
(f) MECHANICAL MAINTENANCE ASSISTANTS. Salary Class "H," Grade 13. £458 to £476 per annum.
(g) ELECTRICAL MAINTENANCE ASSISTANTS Salary Class "H," Grade 13. £458 to £476 per annum.

For (a) candidates should be Associate Members of the Institution of Mechanical or Electrical Engineers (or have equivalent qualifications) and have a sound technical education with practical experience in the operation, maintenance and testing of a modern steam generating station.

For (b) candidates should be well experienced in the electrical maintenance of modern generating plant. Associate Membership of the Institution of Electrical Engineers or equivalent qualification would be an advantage.

For (c) candidates should be well experienced in the mechanical maintenance of a modern generating plant; Associate Membership of the Institution of Mechanical Engineers or equivalent qualification would be an advantage.

For (d) candidates must have had experience in the operation of a modern turbine plant. Previous experience in a power station and possession of technical qualifications would be an advantage.

For (e) candidates must have knowledge of coal handling and handling plant, coal stocking, railway and motor transport organisation. Previous experience in a power station is desirable.

For (f) candidates must have a sound practical experience in the mechanical maintenance of power station plant. Possession of technical qualifications would be an advantage.

For (g) candidates must have a sound practical experience in the electrical maintenance of power station plant. Possession of technical qualifications would be an advantage.

The gradings for all the above-mentioned appointments should be regarded as provisional, pending their approval by District Joint Board and confirmation by the National Board.

All appointments will be superannuable under the British Electricity Authority and Area Boards' Superannuation Scheme.

(*Continued in next column*)

(*Continued from previous column*)

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and returned to him not later than April 6, 1951.

A. R. COOPER,
Divisional Controller.
(K 238)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the following positions:—

No. 403. ASSISTANT SHIFT CHARGE ENGINEER, Ribble Generating Station, Penwortham, Preston.

Salary range £609-£633 per annum, in accordance with Grade 9, Class "H."

No. 404. SHIFT CHARGE ENGINEER, Padiham Generating Station.

Salary range £579-£609 per annum, in accordance with Grade 7, Class "E."

The salaries for these positions, which are superannuable, will be in accordance with the National Joint Board Agreement.

Candidates should preferably possess technical qualifications, and previous experience in a Generating Station is essential.

Applications, stating age, qualifications, present position, and giving full details of education and experience, should be received by The Establishment Officer, British Electricity House, Wilmslow Road, Manchester 20, not later than March 31, 1951. (K227)

HIS MAJESTY'S COLONIAL SERVICE

THREE vacancies exist for ENGINEERS in the Posts and Telegraphs Department, Nigeria. Appointment will be on three years' probation for pensionable employment in the salary scale £720 to £1,300, the point of entry being determined by war service and approved experience. A cost-of-living allowance of from £57 to £100 is payable.

Free passages are granted for the officer and his wife and assistance of up to £75 for a maximum of two children is granted in respect of their passages or maintenance in the United Kingdom. Furnished quarters, if available, are provided at a rent of £60 to £90 a year. Leave is granted at the rate of one week for each month of resident service in a tour of 18 to 24 months.

Candidates, between the ages of 25 and 35, must be at least Graduates of the Institution of Electrical Engineers, or Assistant Engineers in the British Post Office, and have had experience of carrier and V.F. telegraph circuits, and V.H.F. multi-channel equipment.

Candidates should write for further particulars and a form of application to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, London S.W.1, mentioning this paper and quoting No. 27323/20 (K228)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of SECTION ENGINEER in the Birkenhead District of No. 3 Sub Area, at a salary in accordance with the revised National Joint Board Agreement, Schedule "A," Grade 7 (at present Class "F," £625 to £643 per annum).

Applicants must have the technical qualifications necessary to enable them to become Chartered Electrical Engineers. Experience of the maintenance of 33-kV transformers and switchgear with their associated protective equipment is essential. Operational or manufacturing experience will be an advantage.

The appointment is superannuable and subject to a medical examination.

Applications should be made on a form obtainable by written request from the Manager, No. 3 Sub Area, Merseyside and North Wales Electricity Board, Electricity House, Newgate Street, Chester, and must be returned not later than April 5, 1951. JAMES RANKIN,
Secretary.
(K 229)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

APPOINTMENT OF DISTRICT MANAGER, WEMBLEY

APPLICATIONS are invited for the position of District Manager, Wembley, Middlesex.

Applicants should be fully qualified engineers, having sound commercial and engineering experience gained in the management of electricity undertakings with urban and industrial characteristics, and be Corporate Members of the Institution of Electrical Engineers.

The salary upon appointment will be between £1,100 and £1,200 a year and future salary and conditions of employment will be in accordance with the terms and conditions laid down from time to time by the properly constituted negotiating body.

The successful candidate will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Applications should be addressed to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London N. 14, to reach him not later than April 16, 1951. (K 232)

LONDON ELECTRICITY BOARD

DISTRICT ENGINEER, WEST HAM

APPLICATIONS are invited for the above position. Applicants must have had a thorough theoretical and practical training with technical qualifications equivalent to Corporate Membership of the I.E.E. The necessary experience required includes the operation of h.v. and m.v. systems, the latter applying to both a.c. and d.c. networks. Candidates should have had considerable experience in the control of staff, both technical and manual and be fully familiar with the operation and procedure at works and local advisory committees.

The post has been graded under the National Joint Board Agreement of February 17, 1950, as Class "F", Grade 3, £638 7s. per annum, rising to £908 5s. per annum, inclusive of London Area Allowance. This grading is subject to the approval of the District Joint Board and confirmation by the National Joint Board.

Application forms, obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed not later than April 6, 1951. Please enclose addressed foolscap envelope and quote Ref.: EST/V/1044/T on envelope and all correspondence. (K 242)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

No. 6 Sub-Area (Hull)

JUNIOR ENGINEER (Hull District). (Vacancy No. 36/51)

Applicants must have had a good technical education and experience in the construction, operation and maintenance of h.t. and l.t. underground and overhead distribution systems. Preference will be given to those possessing the Higher National Certificate in Electrical Engineering or equivalent qualifications. The successful applicant will be required to reside in Hornsea.

Salary: N.J.B. Agreement Class "H", Grade 17/14, £375-£451 per annum.

CONSTRUCTIONAL DRAUGHTSMAN (Vacancy No. 36/51).

Candidates should have had experience in all, or any of the following: architecture, building design and construction, structural steel work and bills of quantities.

Duties will include preparation of layouts and working drawings for offices, showrooms, and industrial buildings, also alterations to existing buildings.

Provisional salary: Draughtsman Grade 1, £400 by £25 to £500 per annum.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, within 14 days of the appearance of this advertisement.

No. 7 Sub-Area (Grimsby)

SECOND ASSISTANT DISTRICT ENGINEER (Grimsby) (Vacancy No. 37/51).

Applicants must have had a sound practical training and considerable experience in the operation, maintenance, planning and construction of high and low voltage, underground and overhead networks, sub-station plant and ancillary apparatus. Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers, or who hold an engineering degree, or equivalent qualification.

Salary: N.J.B. Agreement Class "E", Grade 7, £579-£609 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, within 14 days of the appearance of this advertisement. (K 240)

ABERDARE CABLES LIMITED, Aberdare, require several ESTIMATORS with experience in handling home and overseas enquiries for paper insulated cables.—State age, experience and salary required. (K 201)

APPLICATIONS are invited for a number of vacancies for ELECTRICAL ENGINEERING SENIOR DRAUGHTSMEN for the installation of electrical equipment in large civil and military aircraft. Some knowledge of electronic equipment is desirable and possession of O.N.C. or H.N.C. (Elect.) preferable. The vacancies are for Cricklewood and Radlett (Herts) drawing offices. Further vacancies exist at Cricklewood only for Junior Electrical Engineering Draughtsmen for detailing the above work. The positions offer excellent opportunities for advancement to keen men. Write, stating age and full details of experience and qualifications, to: Staff Officer, Handley Page Ltd., Cricklewood, London N.W.2. (H 686)

ASSISTANT INSTALLATION AND SERVICE ENGINEER required, principally for site work on transformers up to 132 kV. Good education and general background required. Opportunities exist for gaining experience on switchgear and electrical machines. Please apply, giving full details of education, career and salary required—to Central Labour Department, The Brush Electrical Engineering Co., Ltd., Loughborough, Leicestershire. (K 217)

CHIEF TECHNICAL OFFICER required by well-known meter and instrument manufacturer. Applicants must possess first-class experience in instruments and light mechanism technology, with academic knowledge of physics and mechanical engineering to degree standard. Post is permanent and pensionable. Salary range, £1,000 to £1,650 per annum, depending on qualifications. Only men of first-class ability and experience will be considered.—Applications, in strictest confidence, to Chairman, Box No. E.T.694, at 191 Gresham House, E.C.2. (K 151)

CLERK (Male) required, quick and accurate at figures, for Electrical Installation Contractors. Must have a good knowledge of trade terms and all types of materials used.—Send full details, including salary required, to K. Preston Ltd., 233 Lewisham Way, London S.E.4. (K 194)

CLERK (male), age 20-22, required for pricing and checking orders. Knowledge of electric heating and cooking appliances an advantage.—Belling and Co., Ltd., Sales Dept., Bridge Works, Enfield. (K 203)

CROMPTON PARKINSON LTD., wish to engage a DESIGNER DRAUGHTSMAN for work on fluorescent fittings development. Experience in this or similar sheet metal work and light electrical apparatus desirable.—Applications should be made in writing to Reference O.P., Crompton Parkinson Ltd., Wheatley, Doncaster. (K 216)

DESIGN DRAUGHTSMAN required for interesting engineering development work. Preference for applicants with H.N.C. or equivalent qualifications, and workshop training. Experience of electrical furnace design, mechanical handling gear, etc., an advantage. Good salary offered to man with initiative and ability to execute designs with minimum technical supervision.—Box No. 4073, Electrical Times. (K 211)

DRAUGHTSMAN, familiar with light electrical mechanism or instruments and preferably with some circuit experience, required by Dowty Equipment Ltd., Arle Court, Cheltenham, for development work on aircraft controls. Age 21-25. Higher National Certificate preferred.—Write to Personnel Manager, stating age, experience and salary required. (K 140)

ELECTRICAL DRAUGHTSMEN, one senior, one junior, required, West Midlands. Experienced low tension control gear layouts and diagrams. Senior man must have knowledge heavy plant layout. Compulsory pension scheme. Canteen facilities. State age, if married, present salary and give references.—Box No. 4041, Electrical Times. (K 120)

ELECTRICAL Contractors, Westminster, require an ASSISTANT and a QUALIFIED ESTIMATING ENGINEER. Applicants to give details of age, experience, references and salary required—treated in strictest confidence.—Box No. 4071, Electrical Times. (H 197)

ELECTRICAL LAYOUT DRAUGHTSMEN required for consulting engineer's office for hydro-electric and thermal power stations, also outdoor type high-voltage sub stations. Senior and junior draughtsmen required. Please give details of experience and salary required.—Apply to Kennedy and Donkin, 12 Caxton Street, S.W.1. (K 248)

FERRANTI LIMITED invite applications for SENIOR APPOINTMENTS of graduate engineers with industrial experience in the design of electricity meters. The posts to be filled carry senior responsibility with excellent prospects, generous salary and pension.—Application forms from the Staff Manager, Ferranti Limited, Hollinwood. Please quote Reference M.E. (H 603)

GENERAL ASSISTANT required for manufacturers to the electrical contracting industry, Croydon area. Experience should include some Draughtsmanship, works experience and some knowledge of office routine. State age and salary required.—Troughton and Young (Manufacturers), Ltd., Imperial Court, Basil Street, Knightsbridge. (K 202)

LIGHTING SALES ENGINEER required for London area by electrical manufacturers E.L.M.A., E.I.E.A. members. National Certificate Elec. Eng. and electrical experience. Lighting knowledge necessary. I.E.S. member preferred. Car driver essential. Salary, bonus, expenses. Pension scheme.—Full particulars to Box No. 4035, Electrical Times. (K 99)

POWER PLANT CHARGE ENGINEER required by major oil company for employment in the Middle East to operate a combined gas and steam turbine station where he will take charge of a shift. Applicants who should be under 30 years of age, must possess a Higher National Certificate in electrical engineering and have served an apprenticeship in the generation division of a power supply organisation undertaking power station control room operation, followed by experience as a boiler house or turbine room charge engineer. Attractive salary plus generous allowance in local currency designed to assist substantially in meeting cost of living, free passages, kit allowance, free medical attention, good leave arrangements, pension scheme.—Write, stating personal particulars and details of qualifications and experience, quoting Dept. F.13.F, to Box 3336 at 191 Gresham House, E.C.2 (H 415)

HIGHLY SKILLED ENGINEER fully conversant with the manufacture of electric lamps and plant maintenance required by Vitality Bulbs, Ltd., Neville Place, Wood Green, London N.22. (K 183)

MALAYA. ELECTRICAL ENGINEER with mechanical experience required for tin mine in Malaya, with own hydro-electric power station. Age 25-30, preferably single. Applicants should have served recognised apprenticeship, be A.M.I.E.E. or have equivalent technical training. Term: three years, with liberal salary, annual increments and H.C.L. allowance; also Provident Fund. Free passage and quarters.—Write, stating age and full details of qualifications and experience, to Box J.642, c/o Streets, 110 Old Broad Street, E.C.2. (K 200)

SENIOR DRAUGHTSMEN with up-to-date experience of h.t. switchgear wanted. Please state qualifications, age and salary required.—Apply: The New Switchgear Construction Co., Ltd., Wellesley Road, Sutton, Surrey. (K 221)

SENIOR DRAUGHTSMAN required for work on power transformers ranging from 100 kVA up to 3,000 kVA, 66,000 V. Ordinary National Certificate in Electrical Engineering preferred. Salary according to age and qualifications. Apply to Personnel Officer, Foster Transformers & Switchgear Ltd., South Wimbledon, S.W.19. (K 223)

SENIOR ELECTRICAL DRAUGHTSMEN required by established British company. Experience of power distribution and lighting installations as applied to the oil refinery and chemical industry preferable. Qualifications to H.N.C. standard. Vacancy also exists for suitable man with some electrical experience for requisitioning material for the above work. Substantial salaries paid.—Write, stating age, qualifications and experience, to Drawing Office, Personnel Officer, Foster Wheeler, Ltd., 3 Ixworth Place, London S.W.3. (K 182)

SWITCHGEAR DRAUGHTSMEN FOR JOHANNESBURG. Applicants must have good practical and technical experience particularly in diagram and schematic work. Single men preferred, age 22 to 25.—Applications in writing, stating details of training, experience, age and salary expected, to Employment and Welfare Manager, Johnson and Phillips, Ltd., Victoria Works, Charlton, S.E.7. (K 226)

VACANCIES exist for ASSISTANT ENGINEERS and experienced DESIGNER-DRAUGHTSMEN with established H.T. switchgear manufacturing company. Applications should include details of qualifications and experience. Houses available to successful candidates.—Box No. 4043, Electrical Times. (K 130)

WINDING SHOP FOREMAN REQUIRED. A.C./D.C. Production. Must be up-to-date and resourceful. State age, experience, salary required, and if a member of any Trade Union. London district.—Box No. 4031 Electrical Times. (K 85)

APPOINTMENTS WANTED

INSTALLATION ENGINEER (39), planning, estimating and supervision of large installations. Commercial, sales and administrative experience. Recently completed large contract abroad for British concern. Preferably London area. Full particulars on request.—Box No. 4067, Electrical Times. (K 175)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed.—Edgware 8631 (4 lines), Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO. LTD., Haddington Street, Hove (Tel. 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CASTINGS. Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (H 268)

OLD-ESTABLISHED manufacturers have capacity for special equipment, machining, winding, light assembly, finishing sheet metal work, etc.—Majestic Electric Co. (1937), Ltd., 15 Queensway, Enfield, Middlesex. (K 166)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installation, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Phone: Chiswick 5105. (A 20)

BRASS Strip, 0·170 in. by 0·056 in. or wider from which to shear. Also 0·136 in. D. approx. Brass Wire. Considerable quantities.—Anderton Springs, Ltd., Bingley, Yorks. (K 244)

ELECTRICAL STEEL OFF-CUTS OR COREPLATES required. Small and large quantities taken, approx. 0·024-in. gauge, minimum width 3 in.—Box No. 4077, Electrical Times. (K 219)

ENAMELLED OR RAYON SILK COPPER WIRE required 27-30 s.w.g.—Renas Eng. Co. Ltd., 107 Albert Road, S.E.25. Tel. ADD 6055. (H 245)

NEW and Secondhand Engines, Diesel, Paraffin and Gas 5 h.p. upwards, all makes.—Full details with prices to: Mr. P. L. Bery, Athenaeum Court, 116 Piccadilly, W.1. (K 148)

SEARCHLIGHT CARBONS wanted in quantities.—EX-STRANS-IM LTD., 336 Watford Way, London N.W.4. (K 247)

STEEL, ALUMINIUM, BRASS, sheets, strip, bars, off-cuts. Any quantity; immediate payments.—Grades Sheared Metal Co. Ltd., Green Lane, Hounslow, Middx. Tel.: Feltham 3274. (K 152)

WANTED, "QUICKWAY" COIL FORMING MACHINE in good condition. Will take all accessories.—Dowding and Mills Ltd., Bordesley, Birmingham 12. (K 106)

WANTED. Surplus stocks of Hand, Precision and Cutting Tools, Twist Drills, Taps and Dies, Files, Reamers, Cutters, etc.—Send details to B. Draper and Son, 1 Grange Road, Kingston-on-Thames. We pay cash upon delivery. (K 76)

WANTED: VOLTMETER reading 60-0-60 V. d.c.; VOLTMETER reading 0-30 60 V. d.c.; AMMETER reading 0-100 amps d.c.; OHMMETER, range one microhm to 5 ohms.—Johnson Precision Instruments (Nottingham) Ltd., 240 Huntingdon Street, Nottingham. (K 74)

WANTED. SCRAP ELECTRIC MOTORS, DYNAMOS AND CABLE. Top prices paid.—H. Reed, 36 Bridge Street, Leatherhead, Surrey. (K 11)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED.—Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED, D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (A 13)

AGENCIES

AGENT, resident in Brussels, in England for the B.I.F., with good connections, wishes to represent British manufacturers of electrical goods.—Please write to Box No. 4075, Electrical Times. (K 218)

FOR SALE

CABLES & WIRE

LEAD CABLES:
7,000 yds. 3/029 twin lead, £60 1,000 yds.
3,000 yds. 7/029 single lead, £47 1,000 yds.
500 yds. 7/029 3-core lead, £144 1,000 yds.
1,500 yds. 16/012 twin twisted maroon flex, £31 17s. 6d. 1,000 yds.
1,000 yds. 16/012 twin circular T.R.S., £47 1,000 yds.
100 30 amp. D. and S. 6-way floating contacts at 45s. each.
100 30 amp. D. and S. 4-way floating contacts at 33s. each.
—Box No. 4045, Electrical Times. (K 131)

DOMESTIC APPLIANCES

IMMERSION HEATERS. Grubb 4 kW. No purchase tax. All lengths, 16 in. to 36 in. Standard voltages. Provision for intermediate loadings. Fully guaranteed and immediate delivery. Write for illustrated brochure, latest lists and trade terms to distributors.—John Owner and Co., Ltd., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

SPECIAL OFFER, ½ in. brass LAMPHOLDER, CORD-GRIP LAMPHOLDER and brass BATTENHOLDERS for disposal; also stock various makes of brand new cable and bakelite electrical accessories.—Alexander Jager Trading Company Limited, 13 Eton Garages, Eton Avenue, London N.W.3. PRI 8778. (K 246)

GENERATING PLANT

ALBION TWW WORKS

DIESEL ENGINES

375 H.P. PETTER VERTICAL 6-CYLINDER COLD STARTING, type 6RC04, speed 500 r.p.m., 6 h.p. Diesel driven starting compressor, air receiver, water and fuel tanks, etc.

225 B.H.P. CROSSLEY VERTICAL 6-CYLINDER COLD STARTING, 480 r.p.m., starting compressor, air receiver, circulating pump, etc.

50 H.P. VERTICAL 3-CYLINDER COLD START ING by Dorman, 3DL 43 h.p. at 1,000 r.p.m., 50 h.p at 1,200 r.p.m., C.A.V. injectors, air filters, tachometers, etc.

38 H.P. LISTER VERTICAL 4-CYLINDER COLD STARTING TANK COOLED, 1,000 r.p.m., 4¼ in. bore by 5½ in. stroke, flywheel 26 in. dia. by 4½ in. face; C.A.V. Bosch injectors, starting handle, water tank, etc.

27/34 H.P. VERTICAL 4-CYLINDER COLD STARTING, National, 27 h.p. at 800 r.p.m., 34 h.p. at 1,000 r.p.m., pulley 18 in. dia. by 15 in. face; silencer, etc.

THOS. W. WARD LIMITED

ALBION WORKS, SHEFFIELD

'Phone: 26311 'Grams: "Forward"

REMEMBER WARDS MIGHT HAVE IT (K 210p)

DIESEL ALTERNATOR SETS from stock: 400/440 V, 3-phase, 50 c/s, 167 kVA "Waukesha/G.E.C.," 1,000 r.p.m.; 150 kVA "Petter/Brush," 500 r.p.m.; 135 kVA "Blackstone/Metro-Vick," 500 r.p.m.; 150 kW "General Motors/Westinghouse," 1,000 r.p.m.; 100 kVA "Deutz," 1,000 r.p.m.; 69 kVA "McLaren/Brush," 1,000 r.p.m.; 65 kVA "Meadows/McFarlane," 1,500 r.p.m.; 62·5 kVA "McLaren/Bruce-Peebles," 1,000 r.p.m.; 50 kVA "National/Bruce-Peebles," 750 r.p.m.; 20 kVA "Lister/Metro-Vick," 1,000 r.p.m. Full details with price post free on request.
Thos. W. Ward, Ltd., Albion Works, Sheffield (Phone 26311, ext. 347). (H 292)

ALBION TWW WORKS

PETROL AND DIESEL ENGINES

DIESEL:—34 H.P. RUSTON VERTICAL RADIATOR COOLED COLD STARTING, 3VSH, developing 34 h.p. at 1,500; 31 h.p. at 1,400; 29½ h.p. at 1,300 r.p.m., air filter, manifold, extension shaft, etc.

24/36 H.P. NEW PETTER VERTICAL 4-CYLINDER, developing 24 h.p. at 1,000 r.p.m., 30 h.p. at 1,200 r.p.m., 36 h.p. at 1,500 r.p.m., fuel filter, air cleaner, standard tools and spares.

30 H.P. TURNER VERTICAL 4-CYLINDER COLD STARTING, 1,400 r.p.m., 24 h.p. at 1,000 r.p.m., radiator, fan, fuel tank, spares, etc.

8 H.P. NEW VERTICAL SINGLE-CYLINDER AIR COOLED DIESEL ENGINE, ARMSTRONG SIDDELEY, 1,200 r.p.m., fuel tank, pressure gauge, air filter.

SEVERAL NEW 4/8 H.P. VERTICAL SINGLE-CYLINDER FOWLER, 750/1,500 r.p.m., flywheel 20 in. dia. by 4 in. face.

PETROL:—7·5 H.P. VERTICAL 4-CYLINDER RADIATOR COOLED INDUSTRIAL PETROL ENGINE by COVENTRY CLIMAX, 1,500 r.p.m., grooved pulley 4½ in. dia., air filter, silencer, etc.

THOS. W. WARD LIMITED

ALBION WORKS, SHEFFIELD

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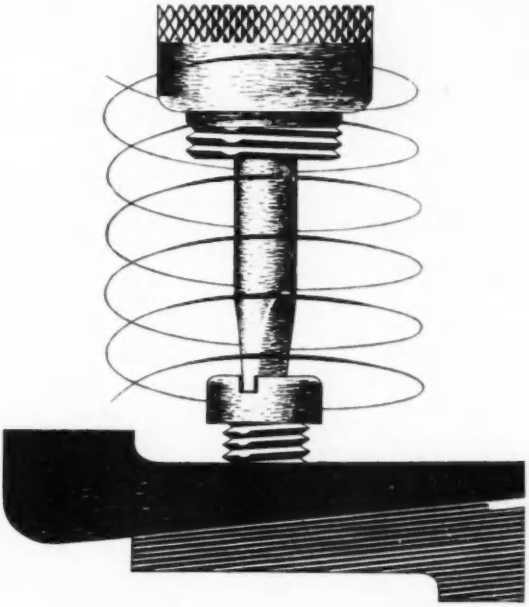

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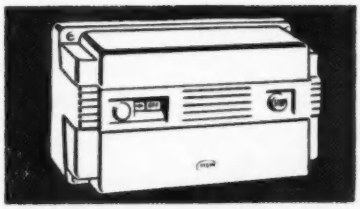

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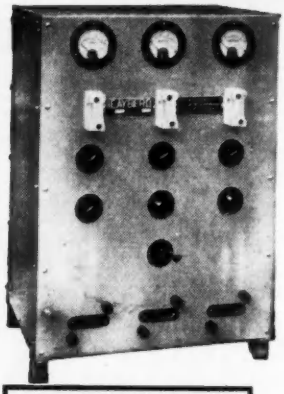

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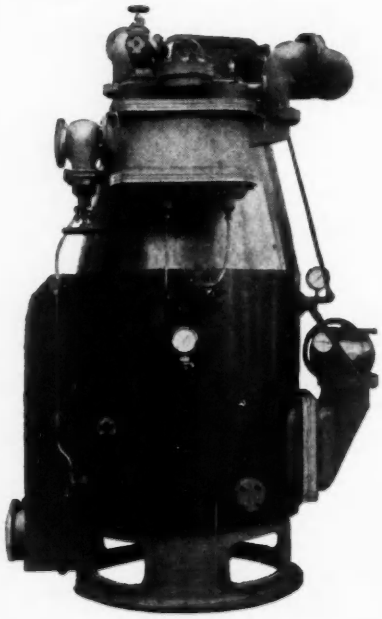

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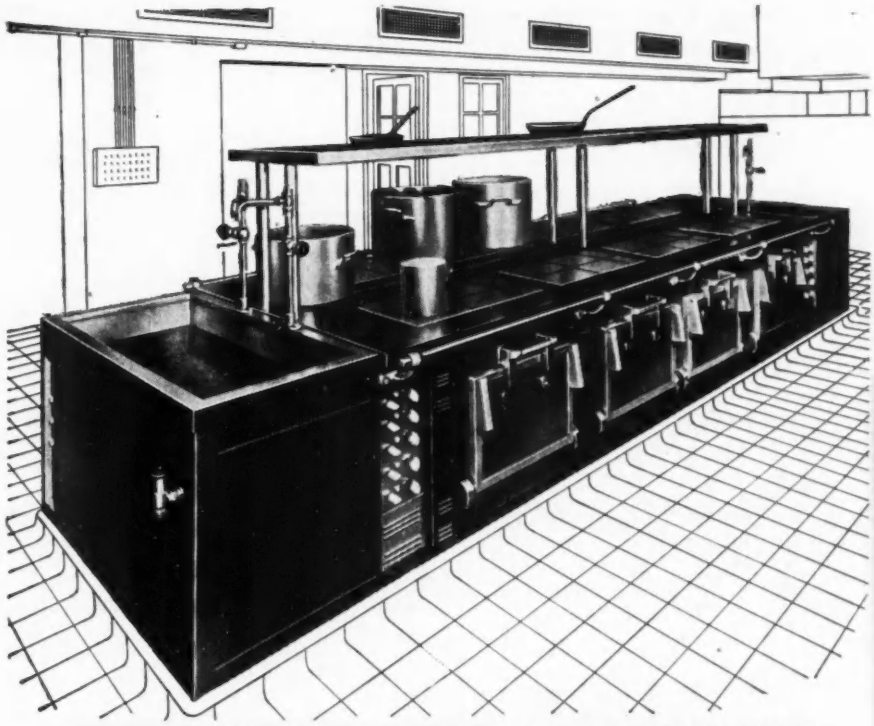

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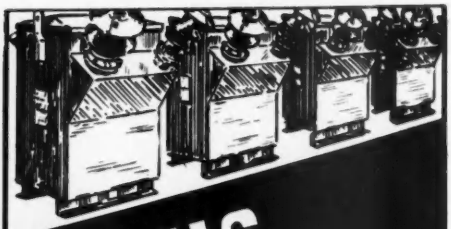

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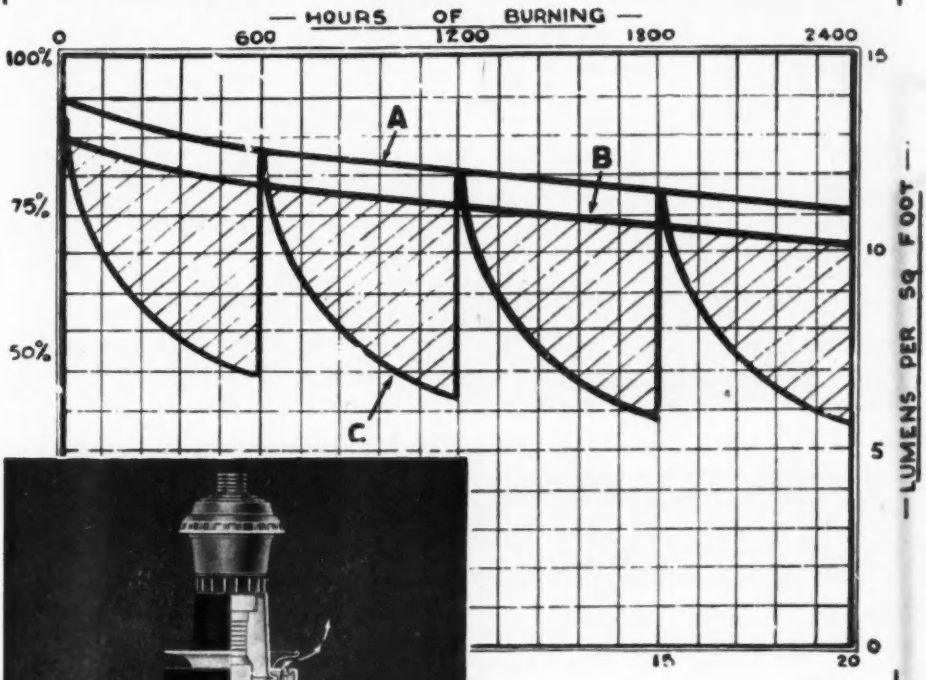

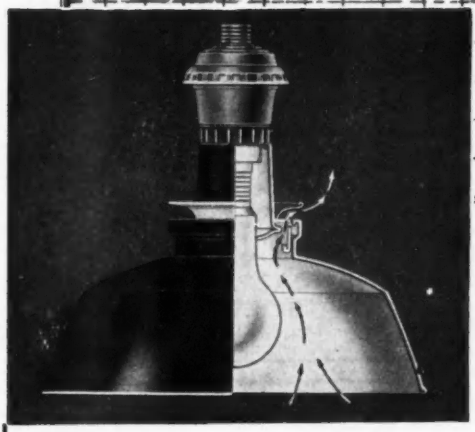

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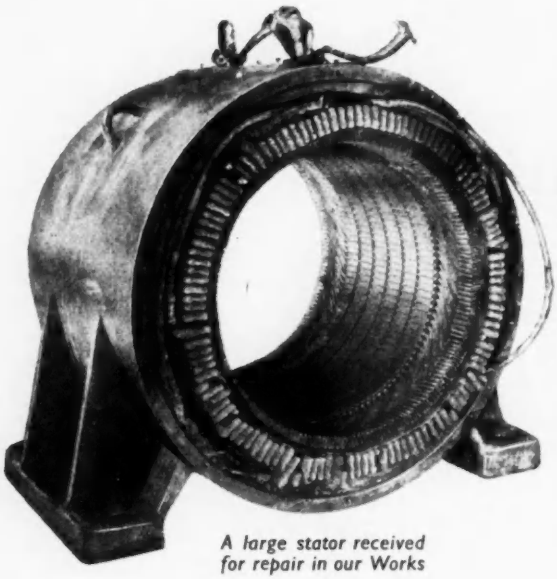

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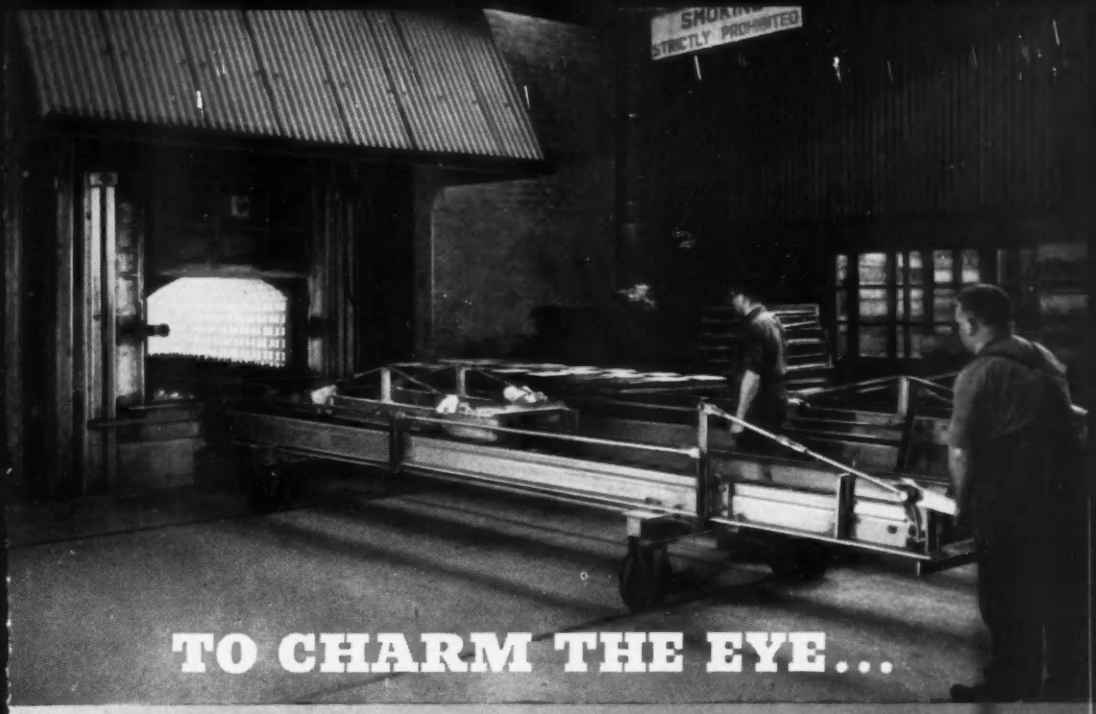

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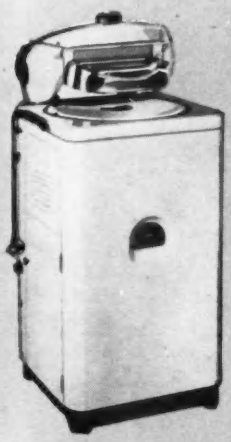

The exceptionally handsome new Parnall Electric Washer is the result of a careful survey of housewives' requirements. It handles a week's family laundry in one hour and among special features are the electric emptying pump, the very latest anti-corrosion treatment of metal parts and the storage recess for the Wringer.

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Among the advantages of this EC 12 cooker are rapid oven heating, enclosed grill, drop-down type balanced door, sunk switches and a heated drawer in the plinth, if required.

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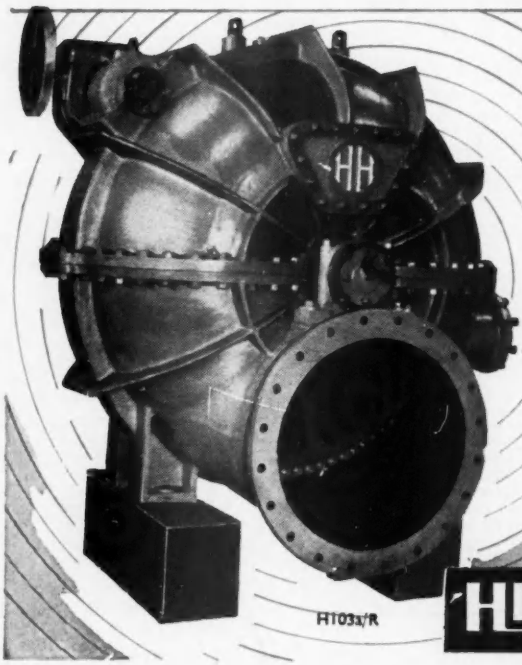

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